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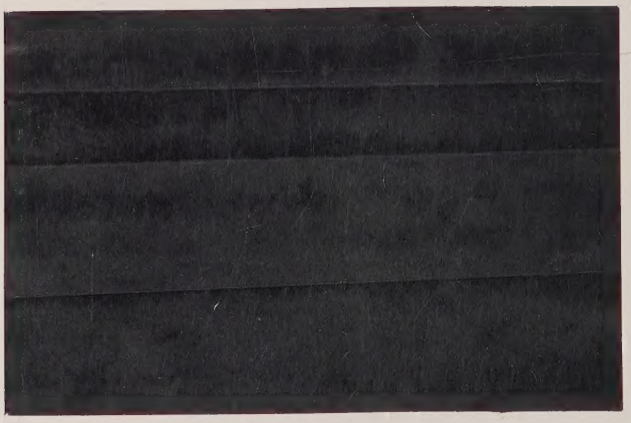
MA28082



CALIFORNIA INSTRUMENTS
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Revision C
April, 1975

VIKING LABORATORIES INC.

INSTRUCTION MANUAL

CIMRON®

MODEL DMM 40

DIGITAL

MULTIMETER

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	200476	ANALOG/DIGITAL SCHEMATIC
	200481	DATA OUTPUT SCHEMATIC
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	200460	UNIT ASSEMBLY
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SPECIFICATIONS

ALL SPECIFICATIONS ARE TESTED IN ACCORDANCE WITH CALIFORNIA INSTRUMENTS TEST PROCEDURE

GENERAL

RANGE SELECTION	Automatic and manual with UP and DOWN range push buttons.
INPUT CONFIGURATION	Fully floating and guarded in all functions.
SAMPLE RATE	Fixed, four readings per second.
CALIBRATION	All calibration controls are accessible by removing top cover. No special tools required.
WARM-UP TIME	Thirty minutes to meet specifications.
SIZE	3-1/2" H x 8-1/2" W x 13" D
WEIGHT	8 lbs. 14. 25 lbs with optional batteries.
TEMPERATURE OPERATING STORAGE	0°C to 50°C -40°C to +75°C
HUMIDITY	The unit shall operate properly in humidity up to 80% (Relative Humidity) non-condensing.
ALTITUDE OPERATING STORAGE	10, 000 feet 50, 000 feet
SHOCK AND VIBRATION	The unit shall be able to withstand normal handling and shipping shock and vibration.

POWER REQUIREMENTS

VOLTAGE	115/230 volts AC ± 10%
POWER	10 watts
FREQUENCY	50 to 440 Hz

MAXIMUM INPUT VOLTAGE

CAUTION

To avoid damaging the DMM 40 the following input signal voltage values must not be exceeded.

DC	1100 volts
AC	700 volts rms
OHMS	±300 volts DC or peak AC (220 volts rms)
LOW TO CHASSIS	±500 volts DC or peak AC

NOTE

All accuracy specifications apply only after the instrument has been calibrated with the equipment listed in Section III. Full scale specifications are based on full scale.

DC VOLTAGE MEASUREMENT

RANGES	
RANGES - FULL SCALE	±.20000, ±2.0000, ±20.000, ±200.00 and ±2000.0 volts full scale (1100 volts maximum)
RESOLUTION	0.005% of range (10 μv on 0.2 volt range)
INPUT RESISTANCE	
0.2 volt range	1000 Megohms
2 volt range	10,000 Megohms
20, 200 and 2000 volt ranges	11 Megohms minimum
OFFSET CURRENT	Less than ±50 pa (23°C)
TEMPERATURE COEFFICIENT	Less than ±5 pa/°C
ACCURACY	
24 HOURS at 23°C ±1°C	
0.2 volt range	±(0.02% of reading +0.005% of full scale)
2, 20, 200, 2000 volt ranges	±(0.01% of reading +0.005% of full scale)
6 MONTHS at 20°C to 30°C	
0.2 volt range	±(0.05% of reading +0.01% of full scale)
2, 20, 200, 2000 volt ranges	±(0.02% of reading +0.005% of full scale)
TEMPERATURE STABILITY	0°C to 50°C
0.2 volt range	±(0.005% of reading +0.001% of full scale) per °C
2, 20, 200, 2000 volt ranges	±(0.002% of reading +0.0005% of full scale) per °C
RESPONSE TIME.	250 milliseconds

SAMPLE RATE	Fixed, four readings per second
NORMAL MODE REJECTION	More than 60 dB at 50 Hz and 10 Hz multiples
COMMON MODE REJECTION	More than 120 dB at DC. More than 100 dB at 50 Hz and 10 Hz multiples

AC VOLTAGE MEASUREMENT

RANGES

RANGE - FULL SCALE (700 volts rms maximum)	.20000, 2.0000, 20.000, 200.00 and 2000.0 volts.

CAUTION

To avoid damaging the DMM 40, the signal input volt-Hertz product must not exceed 1 x 10^7. (See figure 0-1)

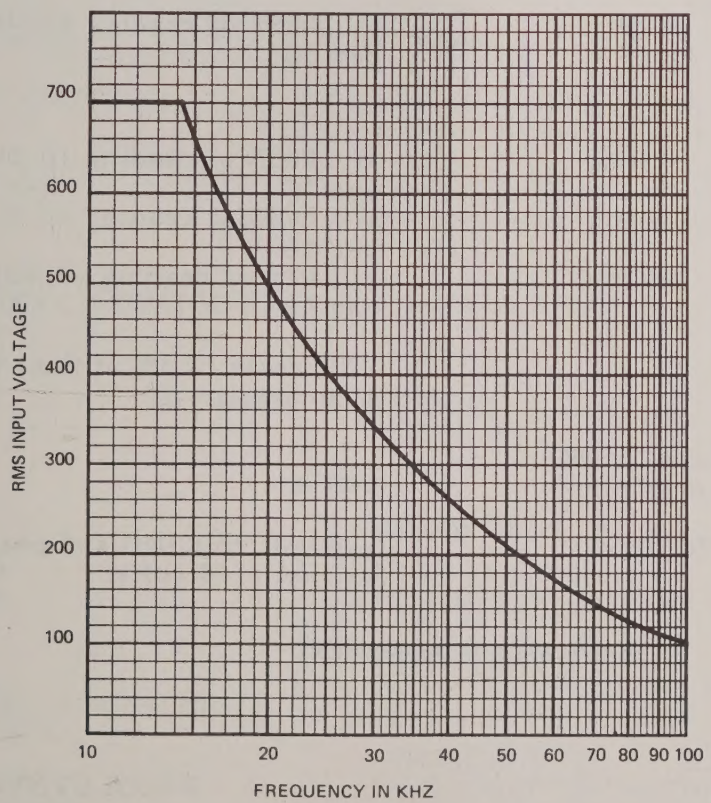


Figure 0-1 MAXIMUM INPUT TO AC (Volt Hertz Product = 10^7) but limited to 50 KHz maximum on 2000V range.

RESOLUTION	0.005% of range (10 μv on .2 volt range)
INPUT IMPEDANCE	1 megohm shunted by less than 50 pf without optional rear panel input.
ACCURACY	
LONG TERM, 6 MONTHS at 20°C to 30°C	
0.2 volt range	
30 Hz - 50 Hz	±(1.5% of reading +0.1% of full scale)
50 Hz - 50 KHz	±(1.0% of reading +0.1% of full scale)
50 KHz - 100 KHz	±(2.0% of reading +0.1% of full scale)
OTHER RANGES	Input volt-Hertz product should not exceed 10^7.
30 Hz - 50 Hz	±(0.9% of reading +0.05% of full scale)
50 Hz - 50 KHz	±(0.1% of reading +0.01% of full scale)
50 KHz - 100 KHz	±(0.9% of reading +0.05% of full scale)
TEMPERATURE STABILITY	0°C to 50°C
0.2 volt range	
50 Hz - 20 KHz	±(0.005% of reading +0.01% of full scale) per °C
OTHER RANGES	
30 Hz - 20 KHz	±(0.003% of reading +0.001% of full scale) per °C
20 KHz - 50 KHz	±(0.005% of reading +0.001% of full scale) per °C
50 KHz - 100 KHz	±(0.02% of reading +0.001% of full scale) per °C
RESPONSE TIME	Full scale (0.1% of final value less than 1 second)
COMMON MODE REJECTION At 50 Hz and 10 Hz multiples	100 dB
MAXIMUM INPUT VOLTAGE	700 volt rms (DC and peak AC not to exceed 1100 volts)

RESISTANCE MEASUREMENT

RANGES

RANGE, FULL SCALE PLUS 100% OVERRANGE	CURRENT THRU R_X	RESOLUTION
.20000 KΩ	1 mA	10 milliohms
2.0000 KΩ	1 mA	100 milliohms
20.000 KΩ	100 μA	1 Ω
200.00 KΩ	10 μA	10 Ω
2000.0 KΩ	1 μA	100 Ω
20,000. KΩ	100 nA	1 KΩ

ACCURACY

LONG TERM, 6 MONTHS
at 20°C to 30°C

0.2 KΩ	±(0.1% of reading +0.025% of full scale)
2 KΩ	±(0.05% of reading +0.01% of full scale)
20 KΩ	±(0.05% of reading +0.01% of full scale)
200 KΩ	±(0.05% of reading +0.01% of full scale)
2000 KΩ	±(0.1% of reading +0.01% of full scale)
20,000 KΩ	±(0.25% of reading +0.01% of full scale)

TEMPERATURE STABILITY	0° to 50°C
.2, 2, 20, 200 KΩ ranges	±(0.002% of reading +0.0025% of full scale) per °C
2000 KΩ range	±(0.005% of reading +0.0025% of full scale) per °C
20,000 KΩ range	±(0.015% of reading +0.0025% of full scale) per °C
RESPONSE TIME	To within ±0.02% of final reading
.2, 2, 20, 200 KΩ ranges	0.1 sec
2000 KΩ range	0.25 sec
20,000 KΩ range	0.50 sec
VOLTAGE PROTECTION	±300 volts DC or peak AC (220 volts rms) without damage on any range
CONFIGURATION	Two wire measurement with front panel lead resistance compensation for a maximum of one ohm.
MAXIMUM OPEN CIRCUIT VOLTAGE	5 volts or less

DC CURRENT MEASUREMENT

RANGES

RANGE	Resolution
±0.2A	10 μA
±2.0A	100 μA

ACCURACY

LONG TERM, 6 MONTHS
at 20°C to 30°C

0.2A range	±(0.15% of reading +0.02% of full scale)
2.0A range	±(0.14% of reading +0.01% of full scale)
TEMPERATURE STABILITY	0°C to 50°C
	±(0.01% of reading +0.001% of full scale) per °C

MAXIMUM INPUT	2 amperes maximum protected by internal breaker. Derated to 1 ampere at 50°C
NORMAL MODE NOISE REJECTION	Same as DC voltage measurement
CONFIGURATION	Shunt internal to instrument

AC CURRENT MEASUREMENT

RANGES

RANGE	Resolution
0.2A	10 μA
2.0A	100 μA

ACCURACY

LONG TERM, 6 MONTHS at 20°C to 30°C

0.2A range 50 Hz - 5 KHz	±(3.0% of reading +0.1% of full scale)
2.0A range 50 Hz - 5 KHz	±(0.3% of reading +0.01% of full scale)
TEMPERATURE STABILITY	0°C to 50°C
2.0A range 50 Hz - 5 KHz	±(0.01% of reading +0.0025% of full scale) per °C
MAXIMUM INPUT	2 amperes maximum protected by internal breaker. Derated to 1 ampere at 50°C
CONFIGURATION	Shunt internal to instrument

GENERAL DESCRIPTION

1.1 SCOPE

This instruction manual contains specifications; description; operating instructions, calibration; theory of operation; and maintenance information, parts lists and diagrams applicable to the Cimron® Model DMM 40 Digital Multimeter.

1.2 GENERAL DESCRIPTION

The Model DMM 40 consists of a Digital Multimeter and optional accessories. The optional accessories are:

Option 01	Battery Pack
Option 02	Isolated Data Output
Option 03	Input Signal Cable
Option 04	Single Rack Mount
Option 05	Dual Rack Mount
Option 06	Rear Input Terminals

1.3 BASIC INSTRUMENT CAPABILITIES

The basic instrument can measure DC voltages from .00001 to ±11000.0; and AC voltages from .00001 to 0700.0 volt rms in 5 ranges. It can measure resistance from .00001K to 20000K in 6 ranges. The ohms circuitry will withstand a fault voltage of 220 volts rms. It will also measure current from .00001A to 2.0000A in 2 ranges by means of circuit breaker protected internal shunting.

The Battery Pack option, when installed, will allow 6 hours of operation between charges and is recharged by an internal charger. (See figure 1-1).

The Isolated Data Output option, when installed, allows isolated data in 1-2-4-8 BCD, TTL compatible outputs. The output data contains 5 decades, range, function and polarity information.

1.4 FABRICATION

The signal input leads are floating and isolated from the case. The internal guard is terminated inside the case at the IN LO terminal.

The input may be floated up to 500 volts DC or peak AC, provided the voltage between any pin on the input connector and the instrument does not exceed 1100 volts peak.

The unit is contained in a half-rack portable case with a front panel bezel and extruded side rails.

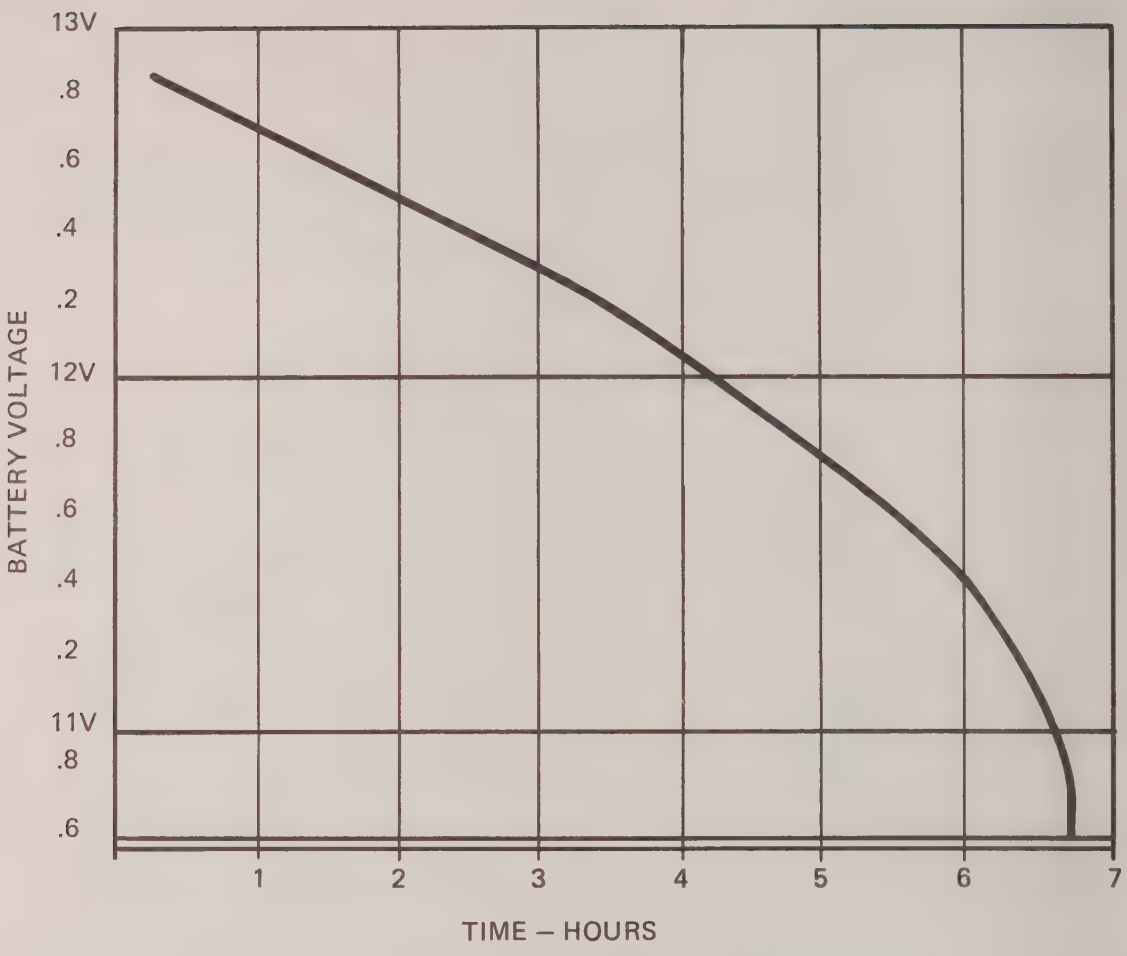
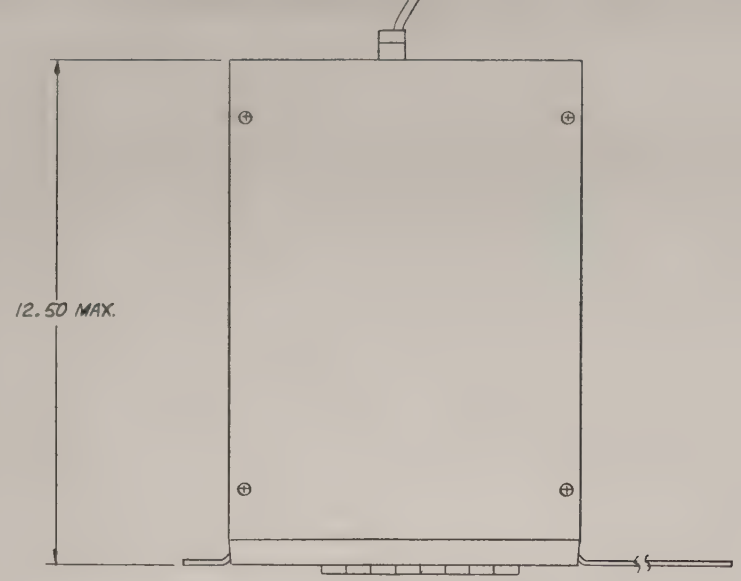
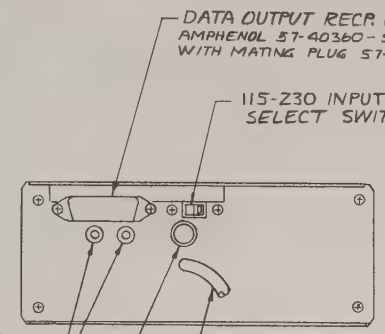


Figure 1-1 TYPICAL BATTERY DISCHARGE CURVE

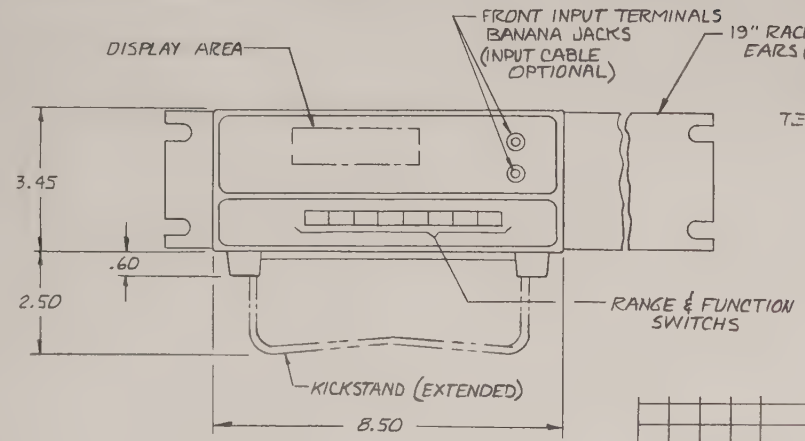
CAUTION

Do not intentionally discharge battery below 11.6V as this will reduce battery life.





REAR VIEW



REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

DIM IN INCHES
TOLERANCES
.XXX = .010
.XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

DWG SIZE C

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TITLE: OUTLINE DRAWING, DIGITAL MULTIMETER

MODEL DMM 90

RELEASE		
CHECKER		PURCHASING
DESIGN		PROJ ENGR
DRFTSMN	ROORDA 3/28/74	CHF ENGR

CALICO
CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. C200854 REV /

SCALE 1/2 SHEET 1 OF 1

CALICO F-168

NOTES: (UNLESS OTHERWISE SPECIFIED)

1-3 B (1-4 BLANK)

C200854

D C B A

4 3 2 1

INSTALLATION AND OPERATION

2.1 OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Instrument operating controls, indicators and connectors are located on the front and rear panels. Table 2-1 lists the operating controls, indicators and connectors and describes the function of each.

2.2 OPERATIONAL CHECKOUT

NOTE

The liability of Cimron® under the warranty is negated if the DMM is improperly repaired. If trouble is experienced during the operational checkout refer to the warranty instructions before attempting repair.

2.3 GENERAL

The operational checkout is intended as a preliminary test of DMM 40 operation. Because of specification tolerances, the actual DMM 40 front panel numerical display may often differ from the exact value expressed in the checkout procedure.

Equipment required for checkout of the DMM 40:

a) DC standard with range of 100 millivolts to 1 kilovolt.

b) AC standard with range of 100 millivolts to 700 volts at 50 Hz to 50 KHz.

c) Decade resistance box, 100 ohms to 10 megohms.

d) 36 pin connector (if print installed).

e) Binary-coded decimal (BCD) recorder suitable for use with the DMM 40.

2.4 PRELIMINARY PROCEDURES

a) Insert input cable into the red and black connectors with ground tab down. Short free ends.

b) Connect power cord into 115 volts or 230 volts AC as applicable, 50 to 400 Hz.

c) Depress PWR, AUTO and DC switches only.

d) Allow 30 minutes warm-up.

e) If required, adjust front panel DC and KΩ zeros.

TABLE 2-1 OPERATING CONTROLS, INDICATORS AND CONNECTORS

CONTROL, INDICATOR OR CONNECTOR	POSITION OR INDICATION	FUNCTION
FRONT PANEL		
Function and Range Selection		Eight station pushbutton array for power, function selection, manual and automatic range selection, positions are POWER AC, DC, 1, K OHM, DN RANGE UP RANGE, and AUTO-RANGE
PWR	Depressed	Applies primary power
AUTO	Depressed	Enables Auto-Range
UP	Momentary Depress/Release	Unlatches AUTO SW
	Momentary Depress/Release	Upranges instrument
DN	Momentary Depress/Release	Unlatches AUTO SW
	Momentary Depress/Release	Downranges instrument
DC	Depressed	Enables DC measurement
AC	Depressed	Enables AC measurement
KΩ	Depressed	Enables resistance measuremen
I	Depressed	Enables current measurement o either AC or DC, as selected. Note: MUST BE UNLATCHED for all other measurements
HI and LO	---	Connects input signal to input selector
Indicators	Illuminated	Indicate input signal value in all functions and polarity in DC.
100 MV zero 1A1R88	Variable	In DC function, 100 millivolts range, with the leads shorted, enables adjustment of front pane displays to all zeros.
Ohms, Zero 1A1R43	Variable	In ohms function, 100Ω range, with leads shorted, enables adjustment to compensate for lead resistance.

ONTROL, INDICATOR R CONNECTOR	POSITION OR INDICATION	FUNCTION
	FRONT PANEL	
splay		±19999 number with decimal indicators for range.
erscale		Display blinks when 19999 counts are exceeded, blinking display is readable and usable for approximately another 4000 counts.
	REAR PANEL	
gnal Input		An option is available providing two banana jacks in parallel with the front High and Low input terminals.
gital Output Connector		A 36 pin connector is supplied on the rear panel providing isolated parallel BCD outputs for Function, Range, Polarity, Four Digits of Numerical Data plus overrange, and Data Ready Command. (This connector is available when the data output option is ordered)
ttery/Line Switch		When the battery option is ordered a pushbutton switch will be provided on the rear panel with two banana jack battery test points.
5-230 (Slide Switch)	115	Enables DMM 40 operation on 105-125 volts AC line power.
	230	Enables DMM 40 operation on 210-250 volts AC line power.

2.5 DC VOLTAGE MEASUREMENT

a) Connect the DMM 40 input leads to the DC standard with the red lead to the positive terminal.

b) Adjust DC standard to 100 millivolts and observe a DMM 40 readout of +.10000.

c) Reverse the DMM 40 leads to the DC standard and observe a readout of -.10000.

d) Successively adjust DC standard to 1, 10, 100, 1000 volts and observe that readouts are -1.0000, -10.000, -100.00, and -1000.0 volts respectively.

e) Reduce DC standard voltage to a safe value and disconnect.

2.6 AC VOLTAGE MEASUREMENT

a) Depress AC function switch.

b) Connect DMM 40 input leads to AC standard.

c) Adjust AC standard to 100 millivolts at 100 Hz. Observe a readout of .10000.

d) Adjust AC standard to 1 volt at 1 KHz. Observe a readout of 1.0000.

e) Adjust AC standard to 10 volts at 10 KHz. Observe a readout of 10.000.

f) Adjust AC standard to 100 volts at 20 KHz. Observe a readout of 100.00.

g) Adjust AC standard to 200 volts at 50 KHz. Observe a readout of 0200.0.

h) Reduce AC standard output to a safe value and disconnect.

2.7 RESISTANCE MEASUREMENT

a) Connect DMM 40 leads to decade resistance box.

b) Depress KΩ function switch.

c) Successively adjust decade resistance box to 100Ω, 1K, 10K, 100K, 1 mΩ and 10 mΩ and observe that readouts are approximately .10000, 1.0000, 10.000, 100.00, 1000.0 and 10000. respectively.

2.8 DATA OUTPUT (If installed)

a) Using a 36 pin Amphenol connector connect the Data Output Board to the digital printer.

b) With the printer in AUTO-PRINT vary the decade resistance box and observe that each printout is the same as the front panel display.

2.9 BATTERY PACK (If installed)

a) With the DMM 40 still in KΩ adjust the decade resistance box to 100 KΩ.

b) Depress the pushbutton on the rear panel to the IN position.

c) Disconnect the line cord and observe that DMM 40 readout is unchanged.

d) Unlatch power switch and rear panel switch.

CALIBRATION AND TEST PROCEDURE

3.1 GENERAL

This section contains procedures for calibrating the DMM 40, (see Table 3-1).

The accuracy of calibration depends on the use of quality test equipment. Test equipment employed should be as good or better than the equipment specified for use in the procedures. For example, if an accurate DC Voltage Calibrator capable of supplying 1000 volts is not available, a lower voltage may be substituted. The accuracy of calibration will be proportionately less, however, as the voltage is decreased.

Before calibrating the instrument, it must be placed in the environment of the work area for 30 minutes to allow the internal temperature to stabilize.

For location of test points and calibration controls, refer to schematic 200476 (sheet 2) and assembly drawing 200475.

3.2 TEST EQUIPMENT REQUIREMENTS

The following equipment is required to perform the calibration procedures:

a) DC Voltage Calibrator, COHU Model 351 or equivalent.

b) AC Calibrator, Hewlett Packard Model 745A with High Voltage Amplifier, Model 746A, or equivalent.

c) Precision resistors.

3.3 CALIBRATION OF BASIC INSTRUMENT

Calibration procedures for the basic DMM 40 are provided on the inner shield and in the following paragraphs. It is recommended that the DMM 40 be calibrated periodically according to usage in accordance with the instructions on the inner shield. An instrument in use every day requires calibration every six months.

3.4 CALIBRATION PROCEDURE (TABLE 3-1 Below)

a) The entire recalibration procedure is on the inner shield.

b) Only if the input amplifier or associated parts have been replaced will A1C50 require readjustment. To adjust A1C50, remove the top shield and place the DMM 40 on the 100 millivolts DC range. Short the input leads. Adjust the front panel DC offset for zero on readout. Connect a 1 megohm resistor across the input leads and adjust A1C50 for zero on the readout.

FUNCTION	RANGE	INPUT	ADJUSTMENT	ADJUST TO
DC	.1 V	Short	A1R88	±.00000
	1 V	+1 MV	A1R134	+0.0010
		-1 MV	A1R133	-0.0010
		-2 V	A1R129	-2.0000
		+2 V	A1R127	+2.0000
	10 V	+20 V	A1R77	+20.000
	100 V	+200 V	A1R80	+200.00
	1 KV	+1 KV	A1R83	+1000.0
		+.1 V	A1R90	(Front Panel DC) +.10000
K Ohm	100 K	Short	A1R44	000.00
	100 K	100 K	A1R40	100.00
	1 M	1 M	A1R38	1000.0
	10 M	10 M	A1R36	10000.
	10 K	10 K	A1R33	10.000
	100	Short	A1R43	.00000
	1K	1K	A1R30	(Front Panel Ohm) 1.0000
AC	1 KV	1 V 5 KHz	A1R61	0001.0
		700 V 100 Hz	A1R64	0700.0
		200 V 50 KHz	A1C29	0200.0
	1 V	1 V 100 Hz	A1R67	1.0000
		1 V 50 KHz	A1C41	1.0000
	10 V	10 V 100 Hz	A1R69	10.000
		10 V 50 KHz	A1C43	10.000
	100 V	100 V 100 Hz	A1R71	100.00
		100 V 50 KHz	A1C45	100.00

THEORY OF OPERATION

4.1 BLOCK DIAGRAM DESCRIPTION

Figure 5-1 is a functional block diagram of the DMM 40 which can be used in conjunction with DMM 40 schematic 200476 in reviewing the theory of operation.

4.2 TIMING

Figures 5-2 and 5-3 represent the sequence of events that control the operation of the logic during the measurement cycle.

4.3 LOGIC DESCRIPTION

a) All gates and all flip-flops will be referred to by the output pin numbers, example: the flip-flop formed by A1Z10 pins 8, 9, 10, 11, 12 and 13 will become flip-flop A1Z10-8 and 11.

b) Truth states for the various types of TTL logic utilized are shown on schematic 200476.

The instrument timing starts with the 1 MHz oscillator A1Z4-10 and A1Z4-12 and associated components. This 1 MHz frequency is counted down by A1Z3 to 200 KHz at A1Z3-11 and 100 KHz at A1Z3-12. If the instrument is in the $\overline{EX}$ state the 100 KHz is passed through A1Z2-3 and A1Z2-11 to the clock input, pin 1, of A1Z1. In the ER and Eϕ states the 200 KHz is passed by A1Z2-6 to A1Z1.

Integrated circuit A1Z1 is a LSI MOS chip that counts the clock to produce the 4 states of the conversion cycle (EX, ERI, ER2 and Eϕ), counts the ER time, stores the ER count, multiplexes the ER count into the readouts and decodes the up-range and down-range states for the Auto-Range.

Pins 16 and 18 of A1Z1 are both plus during EX time so A1Z5-11 is the $\overline{EX}$ signal. This sets flip-flop A1Z10-8 and 11 to the pin 11 plus state which is the integrator "up slope" period. This continues for exactly 100 milliseconds at which time A1Z5-11 goes positive driving A1Z7-2 negative.

The ER state has now started as A1Z5-1 and A1Z5-2 are plus and A1Z5-3 is negative. Due to the action of A1R18 and A1C11 a very narrow strobe appears at A1Z4-6 which latches the state of the comparator output into flip-flop A1Z13-8 and 11. The output of flip-flop A1Z13-8 and 11 is applied to A1Z11-1 and 4 while the ER state is applied to A1Z11-2 and 5. Thus either A1Z11-3 or 6 will go negative and a reference voltage will drive the integrator back to zero.

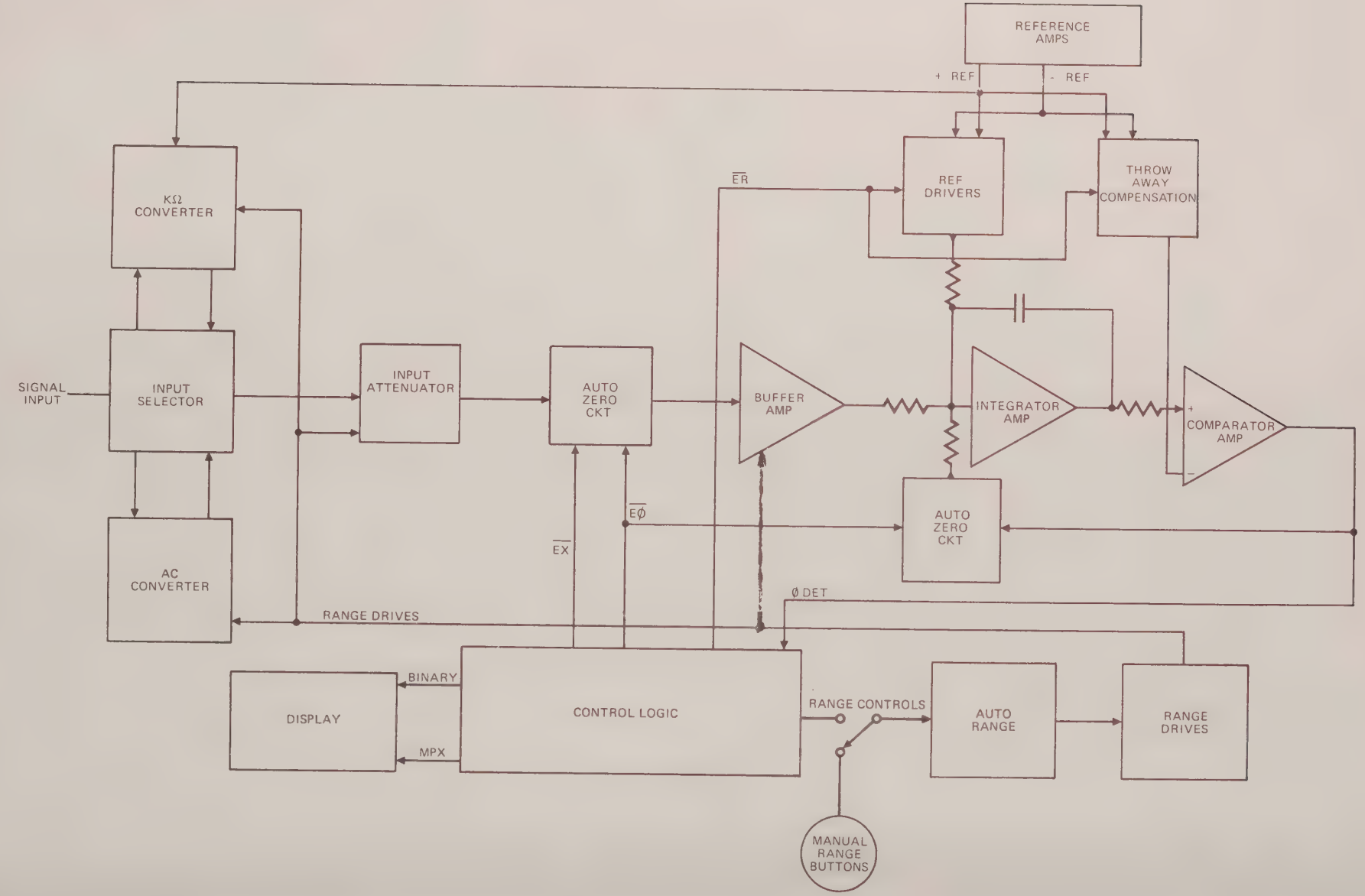


Figure 5-1. DMM 40 Block Diagram

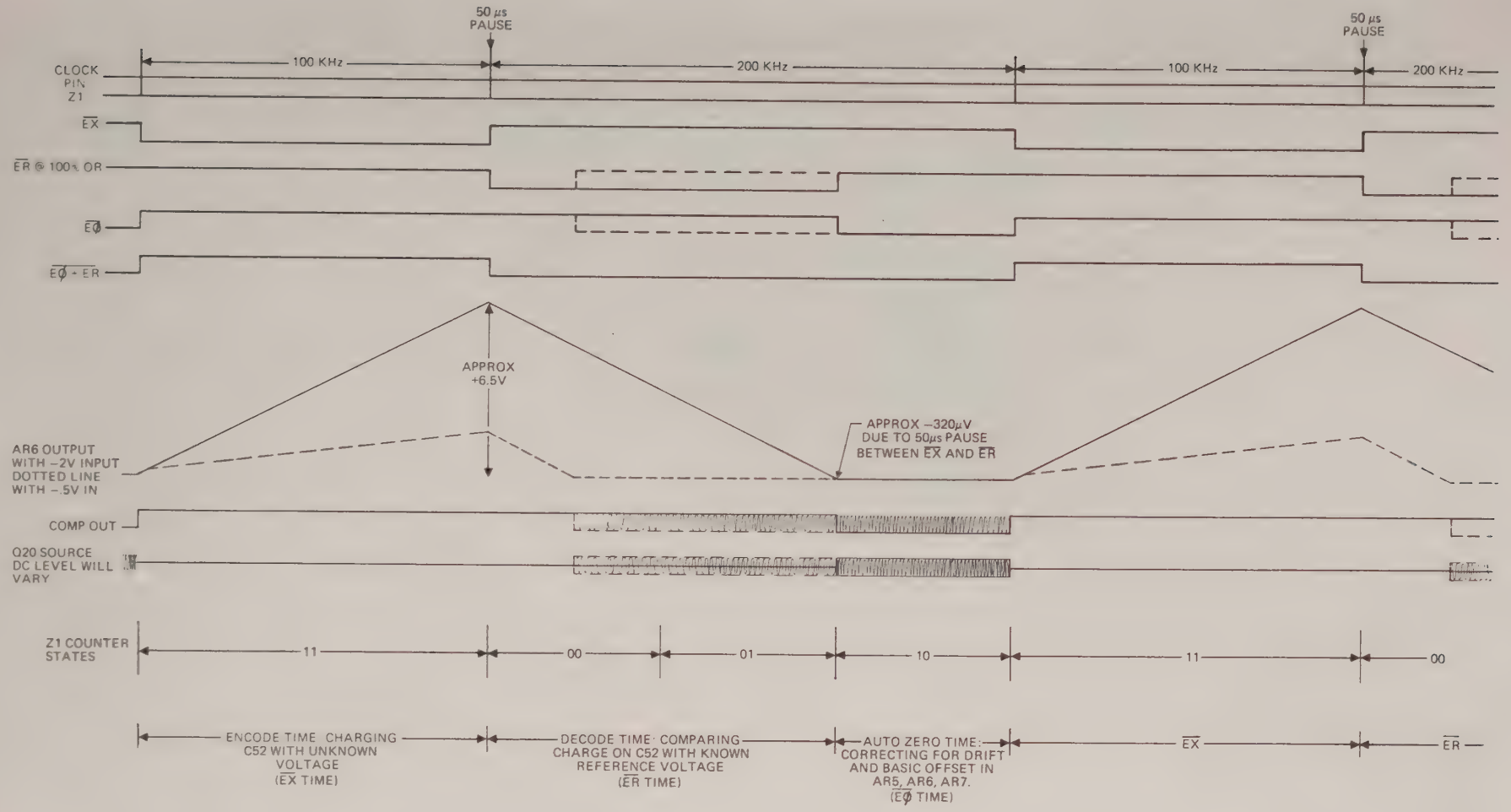


Figure 5-2 • DMM 40 Basic Timing Chart

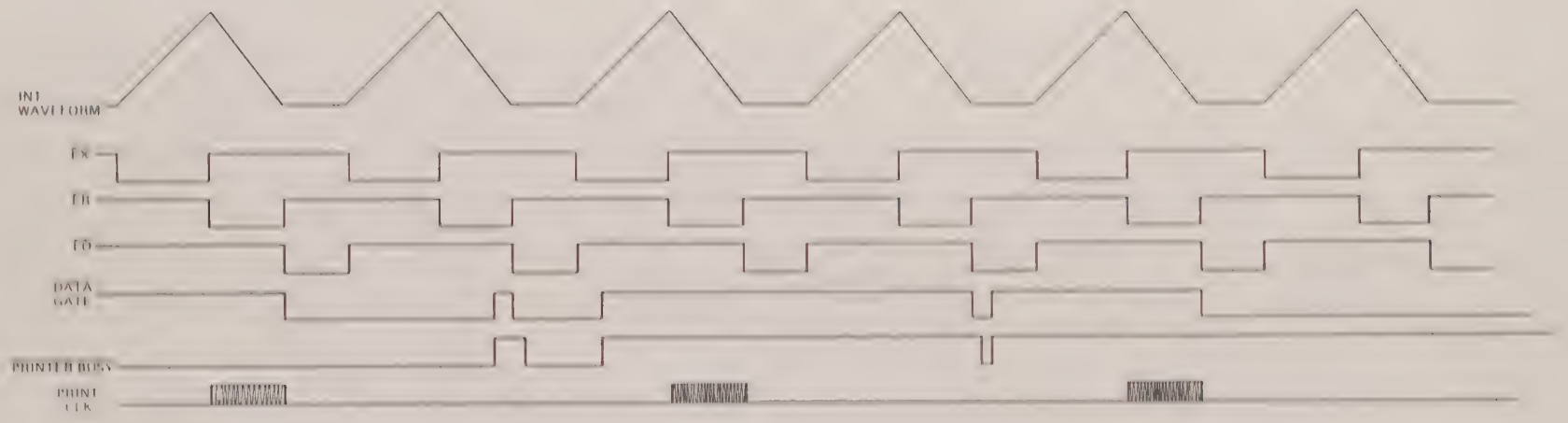


Figure 5-4. PRINTER BUSY Timing Diagram

At the transition from the $\overline{EX}$ to the $\overline{ER}$ state, A1Z1 will pause for 10 counts. This is to prevent switching transients from creating a false zero detect when the instrument is operating near zero input. (In the description of the analog circuitry the means of compensating for this 10 count throw-away will be covered). A1Z10-4 is held negative during $\overline{EX}$ and for a slight delay thereafter to prevent a false zero detect.

When the integrator is driven back through zero the COMP OUT will change states and due to the action of A1C10-A1R14 the exclusive OR gate A1Z6-6 will produce a narrow spike through A1Z7-5 and A1Z10-6 which will reset flip-flop A1Z10-8 and 11. This stops the $\overline{ER}$ state and A1Z10-11 now produces the $\overline{E\phi}$ state. At the same time, A1Z1-2 is driven negative which strobes the ER count into the A1Z1 latches.

The latched binary count is presented in parallel to the five decoder chips on the display from A1Z1 pins 4, 5, 6 and 10 and associated buffers. As this information is being multiplexed at a divide by 100 rate of the clock, only that decoder which has its pin 4 driven plus by the A1Z1 multiplex decode line, will drive its associated display to the ON state. As the multiplex occurs at a 1 KHz rate or greater, the display is refreshed often enough that it appears as an unblinking ON condition.

Pin 9 of A1Z1 will be plus when the stored count exceeds 20,000 counts. A1Z5-4 will go plus at strobe time and A1Z5-6 will be negative until the next $\overline{EX}$ state starts. This is coupled to A1Z1-3 which causes the display to turn off until the next $\overline{EX}$ period creating the over-range "Blink" condition. When in Auto-Range the negative gate at A1Z5-6 is coupled through A1Z4-4 and A1Z8-8 to the up-drive of Auto-Range counter A1Z12.

The down-range condition is created by flip-flop A1Z9-6 and 8. This flip-flop is set each conversion by $\overline{EX}$ and is reset by A1Z1-19 going plus during ER time. Thus, if the ER count is less than 1000, the flip-flop will not be reset and down-range will occur. The down-range gate is coupled through A1Z4-2 and A1Z16-12 to the down-drive of range counter A1Z-12.

The manual range conditions are created by A1S1B, C, and D. When A1S1B is unlatched, the autorange pulses are disconnected and the manual pushbuttons are connected. A1Z23 is used to remove the effects of switch bounce which could cause multiple ranging.

The range counter will count down to range 1 at which time A1Z16-13 will go negative, stopping any further down-drives to A1Z12. The range counter will count up until A1Z8-9 or 10 goes negative. A1Z8-9 will go negative when range 5 is set in DC of AC. A1Z8-10 will go negative when range 6 is set in ohms. If a false range condition occurs when the instrument is turned on or switched from ohms to DC or AC, A1Z16-8 will go plus and the counter will clear itself to range 1.

The range decoding is straight forward and needs no further explanation.

The binary range information is also fed to A2Z4 which is a BCD to 10 line decoder/driver which drives the proper decimal.

A2Q1 and A2Q2 utilize the outputs of flip-flop A1Z13-8 and 11 to drive the proper polarity sign in DC. When the instrument is not in DC the emitters of A2Q1 and A2Q2 are open thus inhibiting the sign.

4.4 ANALOG SECTION

The pushbutton input selector and DC range relays are straight forward and will not be covered in this description.

The input to the A to D is the source of FET A1Q12. When the instrument is in the EX state A1Q12 is on, connecting the input to Buffer A1AR4. The output of A1AR4 is applied to A1R100 which causes A1AR6 to charge integrating capacitor A1C52. At the end of EX A1Q12 is turned off and A1Q13 is turned on which grounds the input to A1AR4. At the same time, (the start of the ER period) either A1Q16 or A1Q17 is turned on to discharge A1C52 at a controlled rate. If the signal were negative, A1Q16 would turn on and at the same time A1Q25 would turn on to displace the zero detect point of A1AR7 by the voltage equivalent of the 10 count pause discussed earlier.

When the output of A1AR6 passes through the compensated zero of A1AR7, the latter will change state and the COMP OUT line will take this change to the logic which will then step to the Eϕ state.

In either ER or Eϕ state A1Q13 is on, shorting the input of A1AR4 to common. In the Eϕ state, A1Q21 is also turned on. This applies the output of the comparator, A1AR7 to source follower A1Q20 gate and then through A1R103 to A1AR6 summing junction. Thus it can be seen that A1AR6 and A1AR7 form a negative feedback loop which will seek an equilibrium. At the end of the Eϕ state, A1Q21 will turn off and the charge on A1C55 will hold the zero correction until the next Eϕ state.

When operating in the 100 millivolts range, A1K12 is actuated by $\overline{\text{A1R1}}$. This grounds A1R91 and the input Buffer A1AR4 changes from a gain of 1 to a gain of 10. Thus the 100 millivolts signal is digitized as 1 volt. A1K12 also grounds A1R96 which changes the FET drive bootstrap to A1R94 and A1R95 so that the gate voltage is the same as the signal voltage.

A1CR44 through A1CR49, A1CR63 and A1CR64 limit the output swing of A1AR5 and A1CR61 and A1CR62 limit the swing of A1AR6. The swing of A1AR7 is limited by A1CR54 and A1CR55.

A1AR8 and associated components form the +10 volt and -10 volt reference amplifiers. A1R129 adjusts the +Ref and A1R127 adjusts the -Ref.

The ohms converter (A1AR1) is an inverting op-amp that uses the +10 Ref as an input and produces a -2 volt full scale output.

The A1AR1 is fault voltage protected in the minus polarity by diode A1CR24 turning off. In the plus polarity the output is current limited to 3.6 ma when A1R47 develops .65 across it and A1Q8 starts to turn off.

A1R43 is the front panel adjustment to compensate for lead resistance in the 100 and 1K range.

The AC converter input is applied through DC blocking capacitor A1C27 and A1R48 to the gate of A1Q9 which is the follower so A1AR2 is driven through A1C30 with the same AC signal applied to A1Q9 gate. The signal is amplified in A1AR2 and applied to rectifier diodes A1CR29 and A1CR30. It is also applied to the DC zero network A1R49, A1R50 and A1C31.

The output of the rectifier diodes is applied to A1R53, A1R54, A1R64 and A1R65. The signal is tapped off at A1R64 and fed back to the summing junction through the appropriate range network thus completing the AC loop.

The output of the rectifier diodes is also applied to differential amplifier A1AR3 which sums the diode output to make a full wave output which is smoothed to DC by A1C36, A1C37, A1C38 and A1C39. This is then coupled to the input of the A to D converter.

4.5 BATTERY PACK
(refer to schematic 200486)

During battery charge (battery pack A4S1 unlatched) the unguarded secondary of power transformer A1T1 is connected across A4J1 pins, 3, 4, and 5. Pin 4 is the center pot. The positive output of bridge rectifier A4CR2 is connected through A4S1 pins 1 and 2 to charging regulator A4Q5.

NOTE

To adjust regulator, disconnect both batteries and replace one of them with a 1K resistor parallel with a 180μf capacitor. Then while monitoring the voltage across the 1K resistor, adjust A4R11 for +6.900 volts DC. The output of the charging regulator is applied through A4S1 to batteries A4BT1 and A4BT2 in parallel.

During battery operate, switch A4S1 is in the depressed position which opens the AC input cable, puts the batteries in series and connects them to the main power switch. When the power switch is depressed, the +12 volt is applied to the center tap of the same winding that charged the battery and through dropping zener A4CR1 to A4Z1 and A4Z2. A4Z1 is a free running multivibrator which operates at approximately 650 Hz. The output of A4Z1 is divided to 325 Hz and balanced by JK flip-flop A4Z2. The outputs of A4Z2 alternately saturate A4Q2 and A4Q3 thus developing a square wave input into power transformer A1T1. Thus a secondary has now become the primary.

NOTE

The type battery used has no "memory" but will not produce 100% of rated power when new. It must be cycled 20 to 40 times before full capacity is reached.

4.6 DATA OUTPUT
(refer to schematic 200481)

At the start of the print cycle A3J1 pin 32 goes plus (controlled by ext printer). This sets R-S flip-flop A3Z11-3 and 6 so pin 6 goes plus and R-S flip-flop A3Z8-8-11 so A3Z8-8 goes minus. A3Z8-8 is inverted and applied to pins 2 and 3 of A3Z1 through A3Z5 holding them in the cleared condition. A3Z11-6 going plus removes the drive to photocoupler A3Z12 allowing A3Z20-13 to go plus.

Due to the nature of the DMM 40 logic, the instrument is not locked up during print. The print board stores the next reading after $\overline{\text{INHIBIT}}$ goes plus, so to ensure a full cycle the set of R-S flip-flop A3Z20-3 and 6 is enabled only during $\overline{\text{E}\phi}$ time.

With R-S flip-flop A3Z20-3 and 6 set A3Z19-9 is plus and when ER goes plus the 200 KHz clock is passed until ER goes minus, at which time R-S flip-flop A3Z20-3 and 6 is reset.

The gated clock is magnetically coupled across the guard by A3T1 and the first clock pulse at A3Z7-2 resets R-S A3Z11-3 and 6 removing the start enable from A3Z20-3.

The same clock is counted by A3Z6 and after 10 counts (to allow for the 10 count throw-away between $\overline{\text{EX}}$ and ER) R-S flip-flop A3Z8-8 and 11 is reset allowing the counters A3Z1 through A3Z5 to accept the count.

NOTE

Do not allow the capacitive load on the counters to exceed 50 pfd per line or improper counting may occur.

The Data Gate is driven through photocoupler A3Z13 when A3Z20-6 goes minus at the end of $\overline{ER}$.

Photocouples A3Z14 through A3Z17 bring out the polarity and range information which is stored in quad-latch A3Z10 by the negative transition of the data gate.

The function information is brought from switch contacts on the function switch.

The AC in (8 and 9 of A3P1) comes from the same winding as used in the battery operation. It is rectified by A3CR1 through A3CR4 and regulated by A3Q1. This is the interface 5 volt (I + 5 volts) that powers that portion of the data output which is outside the guard.

NOTE

The red wire at A1E16 must be unsoldered, insulated and tied back out of the way when print is installed in the DMM 40.

MAINTENANCE AND TROUBLESHOOTING

5.1 GENERAL MAINTENANCE

The CIMRON® DMM 40 Digital Multimeter is a solid state instrument designed to give years of trouble free service. Since the instrument has no moving parts, maintenance is limited to periodic cleaning in accordance with good commercial shop practices.

5.2 TROUBLESHOOTING

Experience has shown that often the difficulties encountered with equipment are poor input signals or misinterpretation of specifications. Check that the input is not noisy and/or erratic, and that the specifications of this instrument are fully understood.

Only skilled personnel who have studied the theory or operation section of this manual should attempt to repair the instrument.

WARNING

HIGH VOLTAGE (115/230 VAC)

This equipment contains potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions.

The troubleshooting flow test, series A through series F, are an aid to fault isolation. They are not intended to be a replacement for good troubleshooting procedures.

If a DMM 40 has a malfunction, use the appropriate test series as follows:

A) Display not lighted

B) Reading locked up or a single digit light

B_1) Analog lock up (This is a sub series of B)

C) DC inaccurate

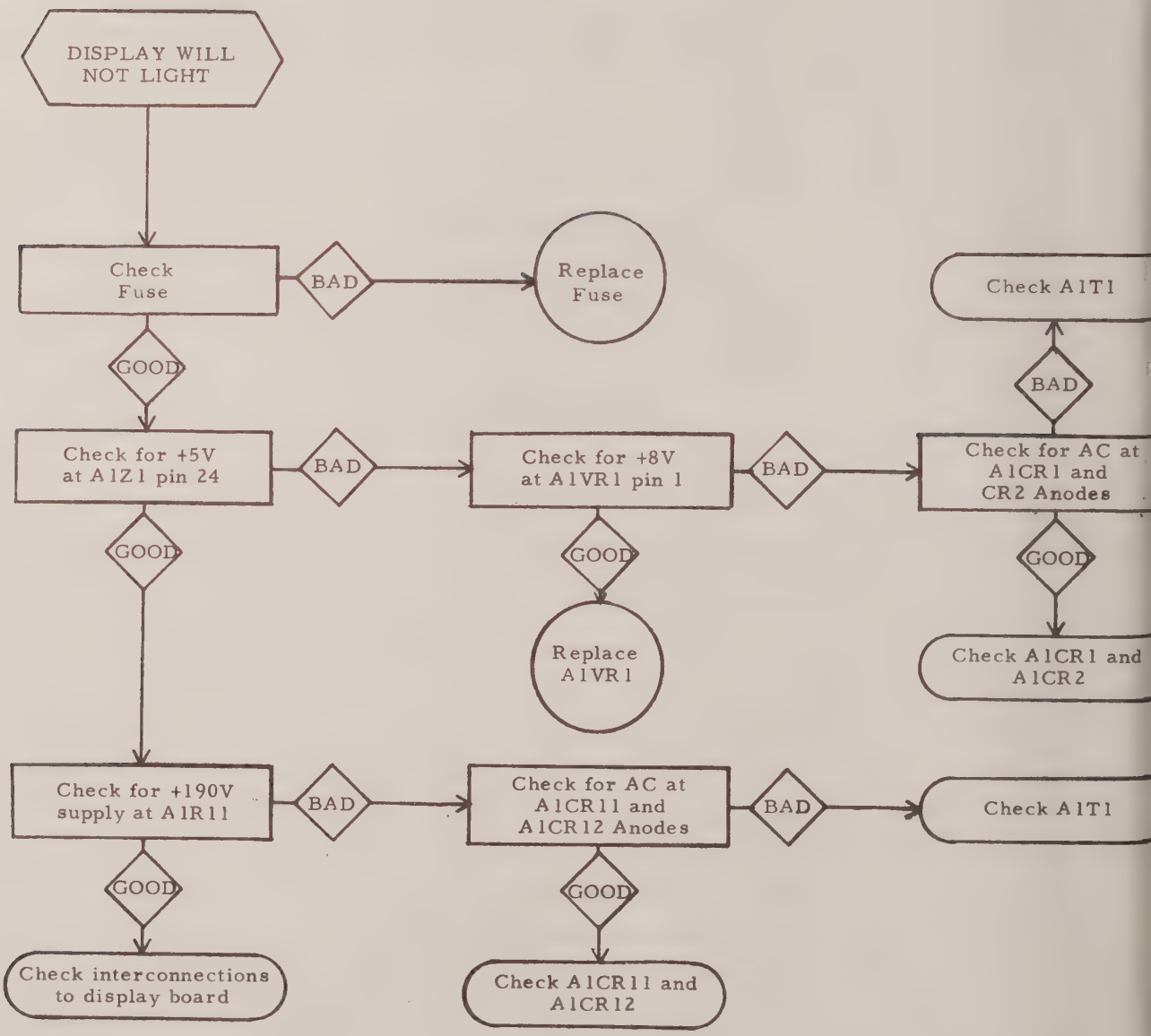
D) Range selection malfunction

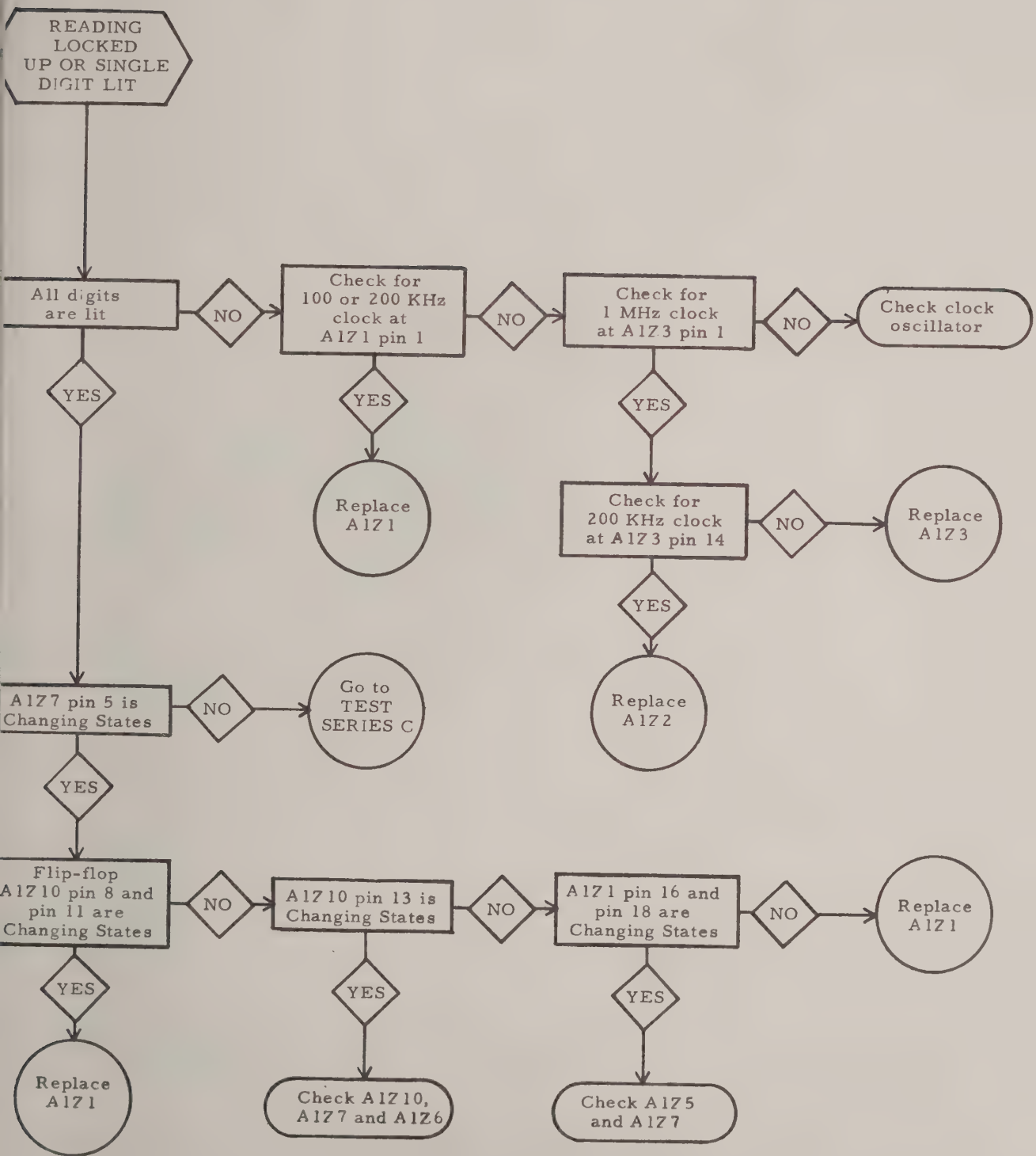
E) AC converter malfunction

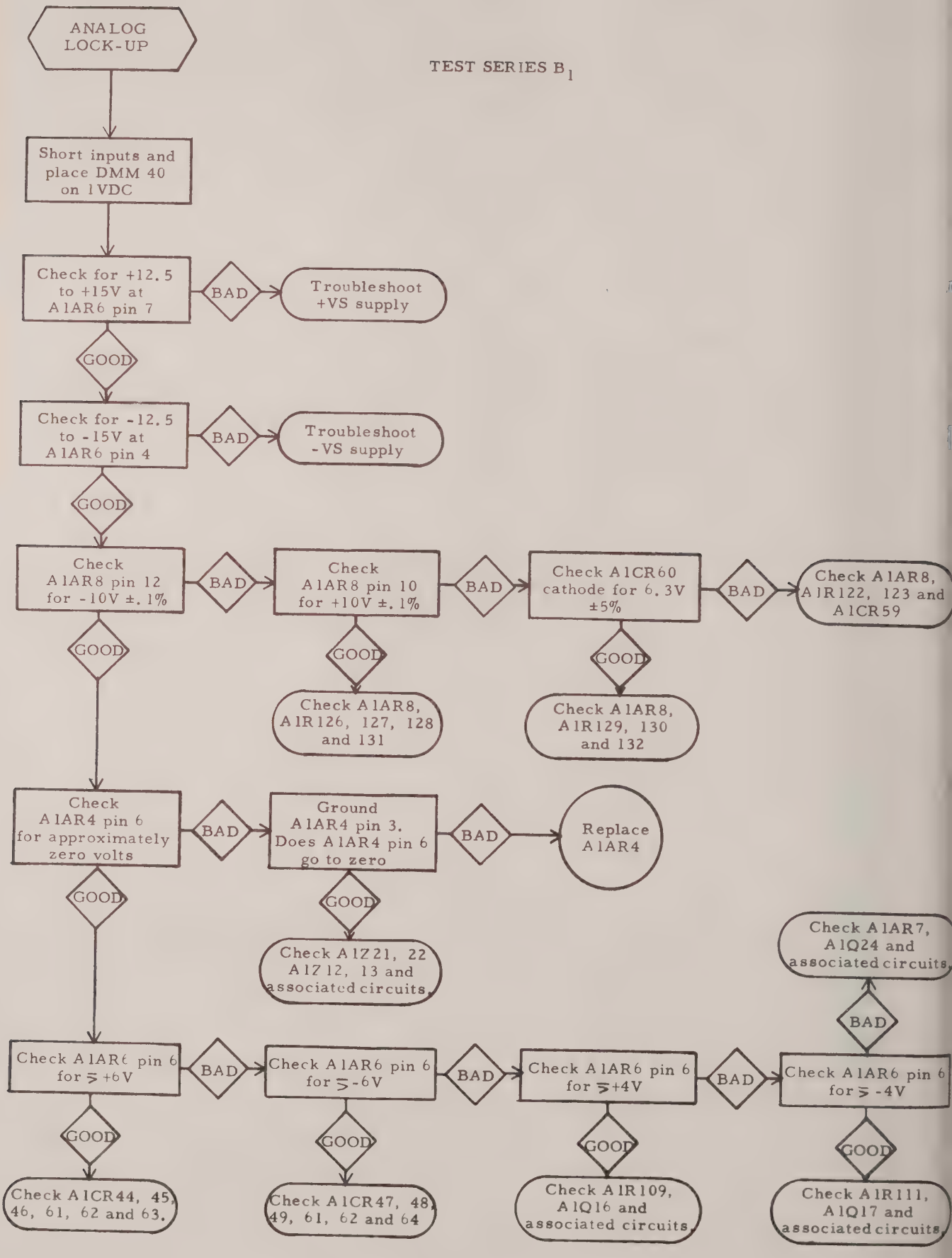
F) KΩ converter malfunction

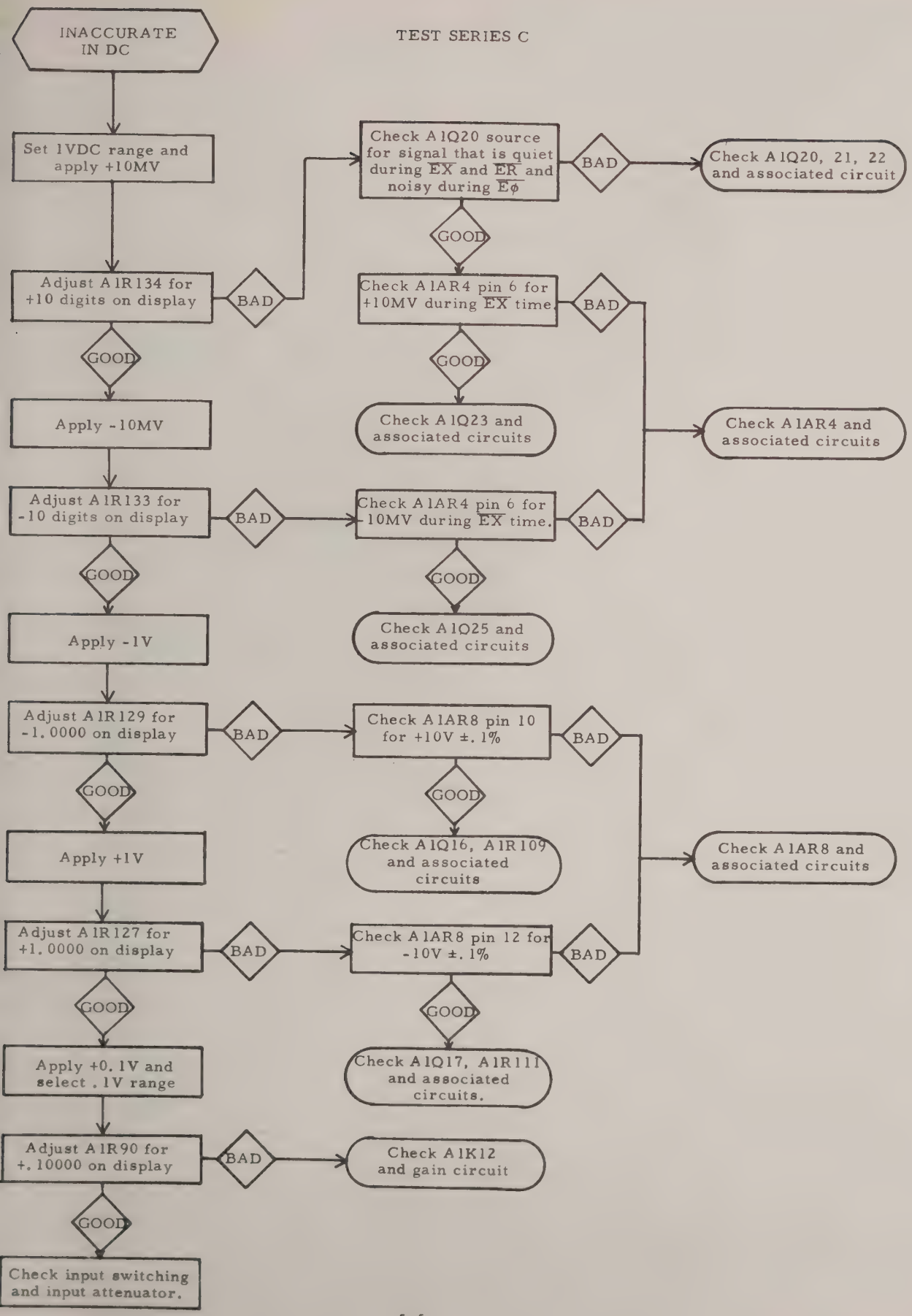
REFER TO ANALOG/DIGITAL SCHEMATIC 200476
ADD ANALOG/DIGITAL ASSEMBLY DRAWING 200475
FOR COMPONENT LOCATION INFORMATION

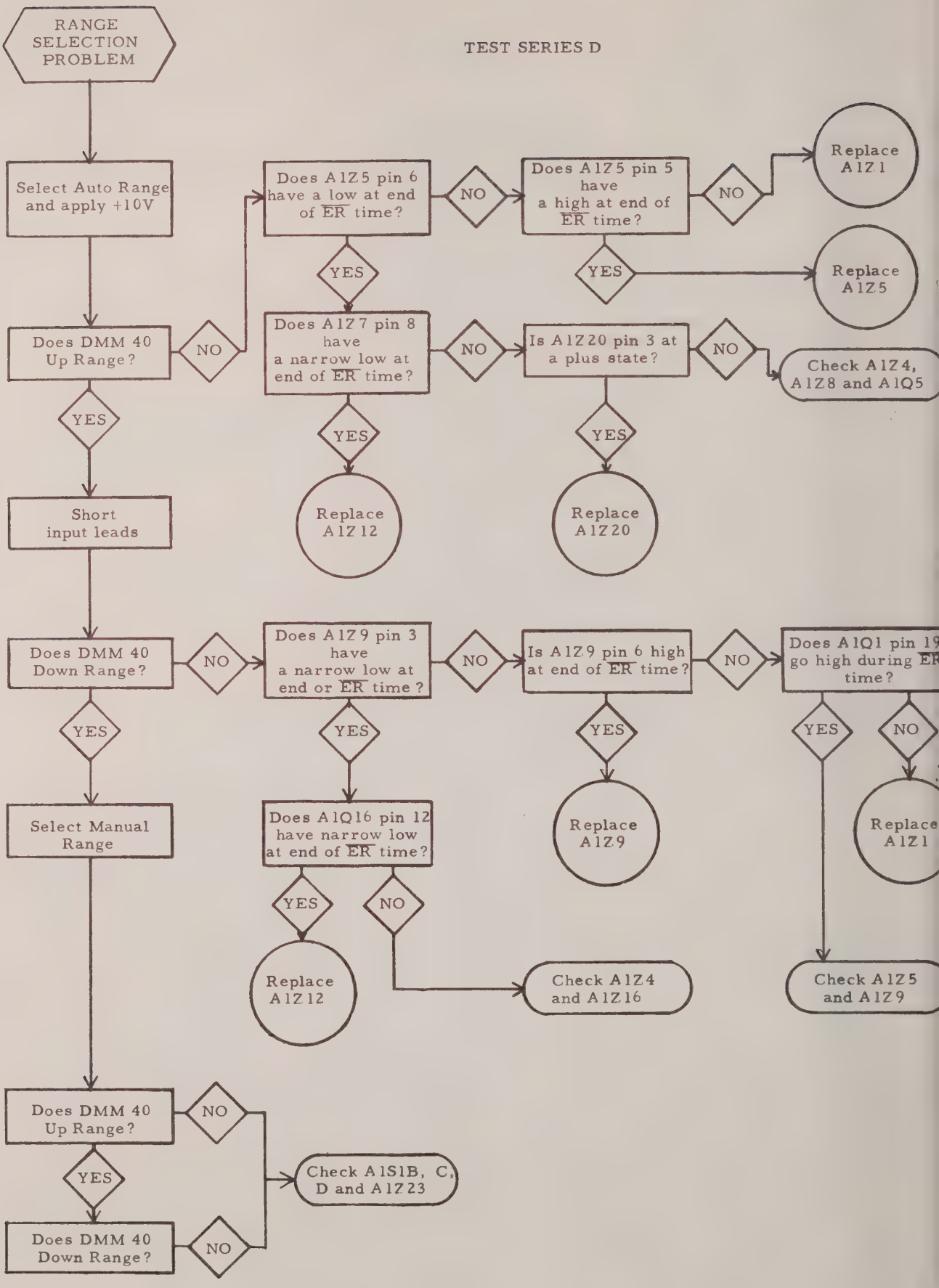
TEST SERIES A

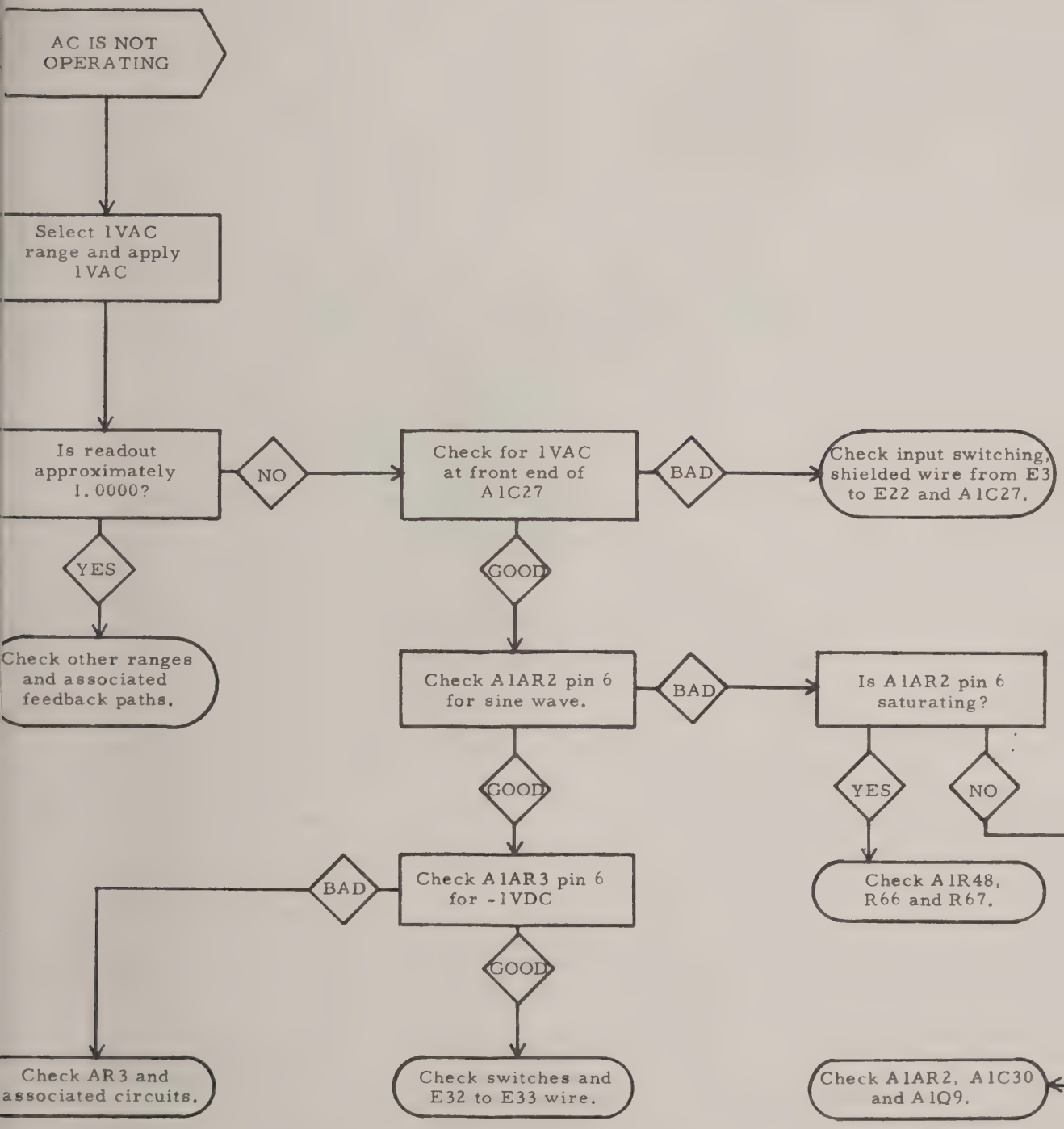


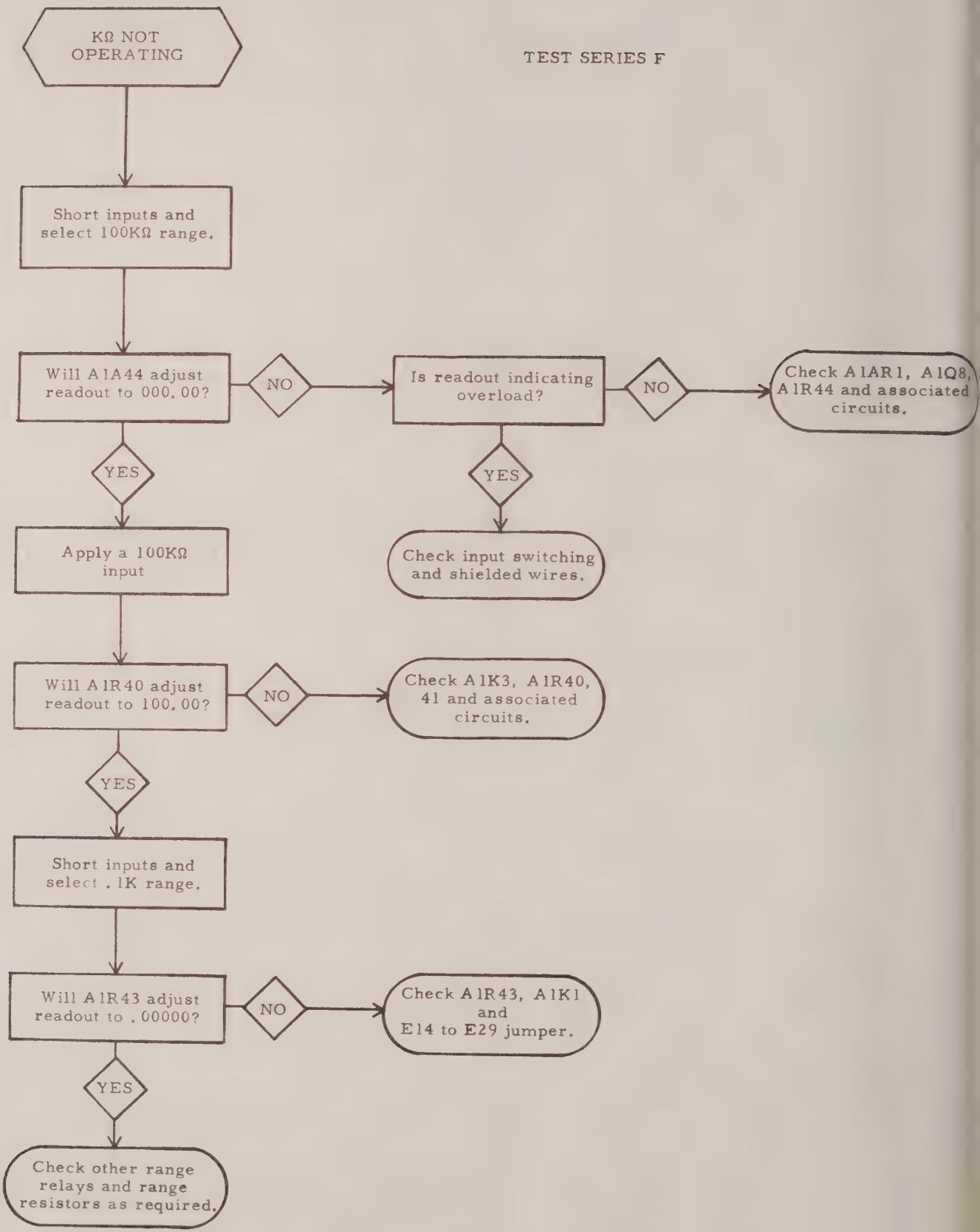

READING LOCKED UP OR SINGLE DIGIT LIT
All digits are lit
NO
Check for 100 or 200 KHz clock at A1Z1 pin 1
NO
Check for 1 MHz clock at A1Z3 pin 1
NO
Check clock oscillator
YES
YES
YES
Replace A1Z1
Check for 200 KHz clock at A1Z3 pin 14
NO
Replace A1Z3
YES
Replace A1Z2
A1Z7 pin 5 is Changing States
NO
Go to TEST SERIES C
YES
Flip-flop A1Z10 pin 8 and pin 11 are Changing States
NO
A1Z10 pin 13 is Changing States
NO
A1Z1 pin 16 and pin 18 are Changing States
NO
Replace A1Z1
YES
YES
YES
Replace A1Z1
Check A1Z10, A1Z7 and A1Z6
Check A1Z5 and A1Z7


ANALOG LOCK-UP
Short inputs and place DMM 40 on 1VDC
Check for +12.5 to +15V at A1AR6 pin 7
BAD
Troubleshoot +VS supply
GOOD
Check for -12.5 to -15V at A1AR6 pin 4
BAD
Troubleshoot -VS supply
GOOD
Check A1AR8 pin 12 for -10V ±.1%
BAD
Check A1AR8 pin 10 for +10V ±.1%
BAD
Check A1CR60 cathode for 6.3V ±5%
BAD
Check A1AR8, A1R122, 123 and A1CR59
GOOD
GOOD
Check A1AR8, A1R126, 127, 128 and 131
GOOD
Check A1AR8, A1R129, 130 and 132
Check A1AR4 pin 6 for approximately zero volts
BAD
Ground A1AR4 pin 3. Does A1AR4 pin 6 go to zero
BAD
Replace A1AR4
GOOD
GOOD
Check A1Z21, 22 A1Z12, 13 and associated circuits.
Check A1AR6 pin 6 for ≥ +6V
BAD
Check A1AR6 pin 6 for ≥ -6V
BAD
Check A1AR6 pin 6 for ≥ +4V
BAD
Check A1AR6 pin 6 for ≥ -4V
BAD
Check A1AR7, A1Q24 and associated circuits.
GOOD
GOOD
GOOD
GOOD
Check A1CR44, 45, 46, 61, 62 and 63.
Check A1CR47, 48, 49, 61, 62 and 64
Check A1R109, A1Q16 and associated circuits.
Check A1R111, A1Q17 and associated circuits.


INACCURATE IN DC
Set 1VDC range and apply +10MV
Adjust A1R134 for +10 digits on display
BAD
GOOD
Apply -10MV
Adjust A1R133 for -10 digits on display
BAD
GOOD
Apply -1V
Adjust A1R129 for -1.0000 on display
BAD
GOOD
Apply +1V
Adjust A1R127 for +1.0000 on display
BAD
GOOD
Apply +0.1V and select .1V range
Adjust A1R90 for +.10000 on display
BAD
GOOD
Check input switching and input attenuator.
Check A1Q20 source for signal that is quiet during $\overline{EX}$ and $\overline{ER}$ and noisy during $\overline{E\phi}$
BAD
Check A1Q20, 21, 22 and associated circuit
GOOD
Check A1AR4 pin 6 for +10MV during $\overline{EX}$ time.
BAD
GOOD
Check A1Q23 and associated circuits
Check A1AR4 pin 6 for -10MV during $\overline{EX}$ time.
BAD
GOOD
Check A1Q25 and associated circuits
Check A1AR4 and associated circuits
Check A1AR8 pin 10 for +10V ±.1%
BAD
GOOD
Check A1Q16, A1R109 and associated circuits
Check A1AR8 pin 12 for -10V ±.1%
BAD
GOOD
Check A1Q17, A1R111 and associated circuits.
Check A1AR8 and associated circuits
Check A1K12 and gain circuit


RANGE SELECTION PROBLEM
Select Auto Range and apply +10V
Does DMM 40 Up Range?
NO
YES
Short input leads
Does DMM 40 Down Range?
NO
YES
Select Manual Range
Does DMM 40 Up Range?
NO
YES
Does DMM 40 Down Range?
NO
Check A1S1B, C, D and A1Z23
Does A1Z5 pin 6 have a low at end of ER time?
NO
YES
Does A1Z7 pin 8 have a narrow low at end of ER time?
NO
YES
Replace A1Z12
Does A1Z9 pin 3 have a narrow low at end or ER time?
NO
YES
Does A1Q16 pin 12 have narrow low at end of ER time?
YES
NO
Replace A1Z12
Check A1Z4 and A1Z16
Does A1Z5 pin 5 have a high at end of ER time?
NO
YES
Replace A1Z1
Replace A1Z5
Is A1Z20 pin 3 at a plus state?
NO
YES
Check A1Z4, A1Z8 and A1Q5
Replace A1Z20
Is A1Z9 pin 6 high at end of ER time?
NO
YES
Replace A1Z9
Does A1Q1 pin 19 go high during ER time?
YES
NO
Check A1Z5 and A1Z9
Replace A1Z1


AC IS NOT OPERATING
Select 1VAC range and apply 1VAC
Is readout approximately 1.0000?
NO
Check for 1VAC at front end of A1C27
BAD
Check input switching, shielded wire from E3 to E22 and A1C27.
YES
GOOD
Check other ranges and associated feedback paths.
Check A1AR2 pin 6 for sine wave.
BAD
Is A1AR2 pin 6 saturating?
GOOD
YES
NO
BAD
Check A1AR3 pin 6 for -1VDC
Check A1R48, R66 and R67.
GOOD
Check AR3 and associated circuits.
Check switches and E32 to E33 wire.
Check A1AR2, A1C30 and A1Q9.


KΩ NOT OPERATING
Short inputs and select 100KΩ range.
Will A1A44 adjust readout to 000.00?
NO
Is readout indicating overload?
NO
Check A1AR1, A1Q8, A1R44 and associated circuits.
YES
YES
Apply a 100KΩ input
Check input switching and shielded wires.
Will A1R40 adjust readout to 100.00?
NO
Check A1K3, A1R40, 41 and associated circuits.
YES
Short inputs and select .1K range.
Will A1R43 adjust readout to .00000?
NO
Check A1R43, A1K1 and E14 to E29 jumper.
YES
Check other range relays and range resistors as required.

CIRCUIT DIAGRAM

6.1 GENERAL

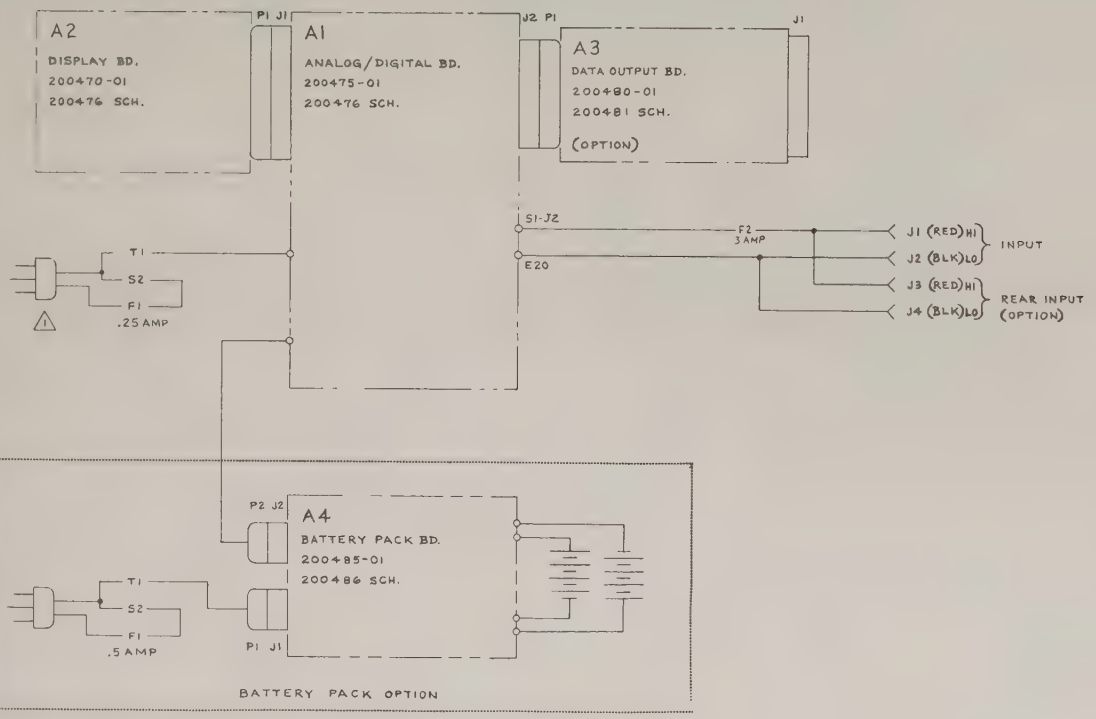
This section contains schematics and mechanical diagrams necessary for operation and maintenance of the Model DMM 40 Digital Multimeter. The schematic diagrams illustrate the circuit while the mechanical assemblies indicate the part placement.

6.2 REFERENCE DESIGNATIONS

Partial reference designators are shown on schematic and mechanical drawings. Prefix these reference designators with assembly and/or sub-assembly designation for the complete reference designator. For example:

Assembly/Sub-Assembly	Component	Component Designation
A1	C8	A1C8
None	J2	J2
A3	R3	A3R3

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INC ECO 716	7/15/75	



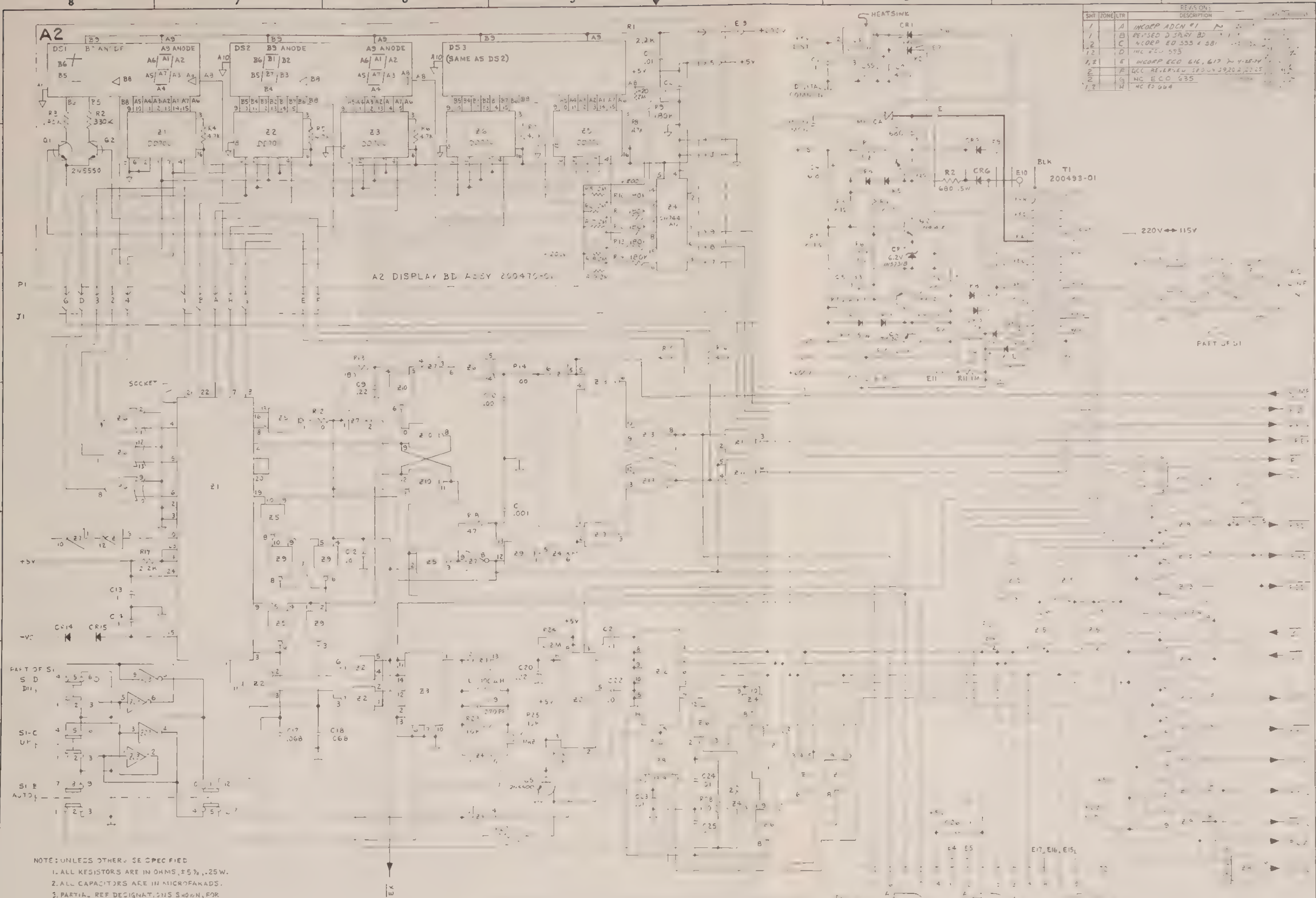
NOTE: UNLESS OTHERWISE SPECIFIED

⚠1 THIS LINE CORD ARRANGEMENT NOT SUPPLIED IF BATTERY PACK OPTION IS USED.

	CONTRACT NO.	CIMRON	
	DRAWN G.L. NICHOLSON 12/1/72	SCHEMATIC - 4 DIGIT DIGITAL MULTIMETER	
	CHK'D		
	ENGR'G		
	APPROVED		
DMM40	MFG APPROVAL	D 15318	200461 A
		SCALE NONE	SHEET 1 OF 1

6-3

200461 A



SHT	ZONE	LTR	REVISIONS DESCRIPTION
1		A	INCORP ADCN #1
1		B	REVISED DISPLAY BD
2		C	INCORP ED 555 & 581
1,2		D	INC ECO 593
1,2		E	INCORP ECO 616, 617 4-25-74
2		F	[illegible] REVERSED [illegible]
2		G	INC ECO 635
1,2		H	INC ECO 664

NOTE: UNLESS OTHERWISE SPECIFIED

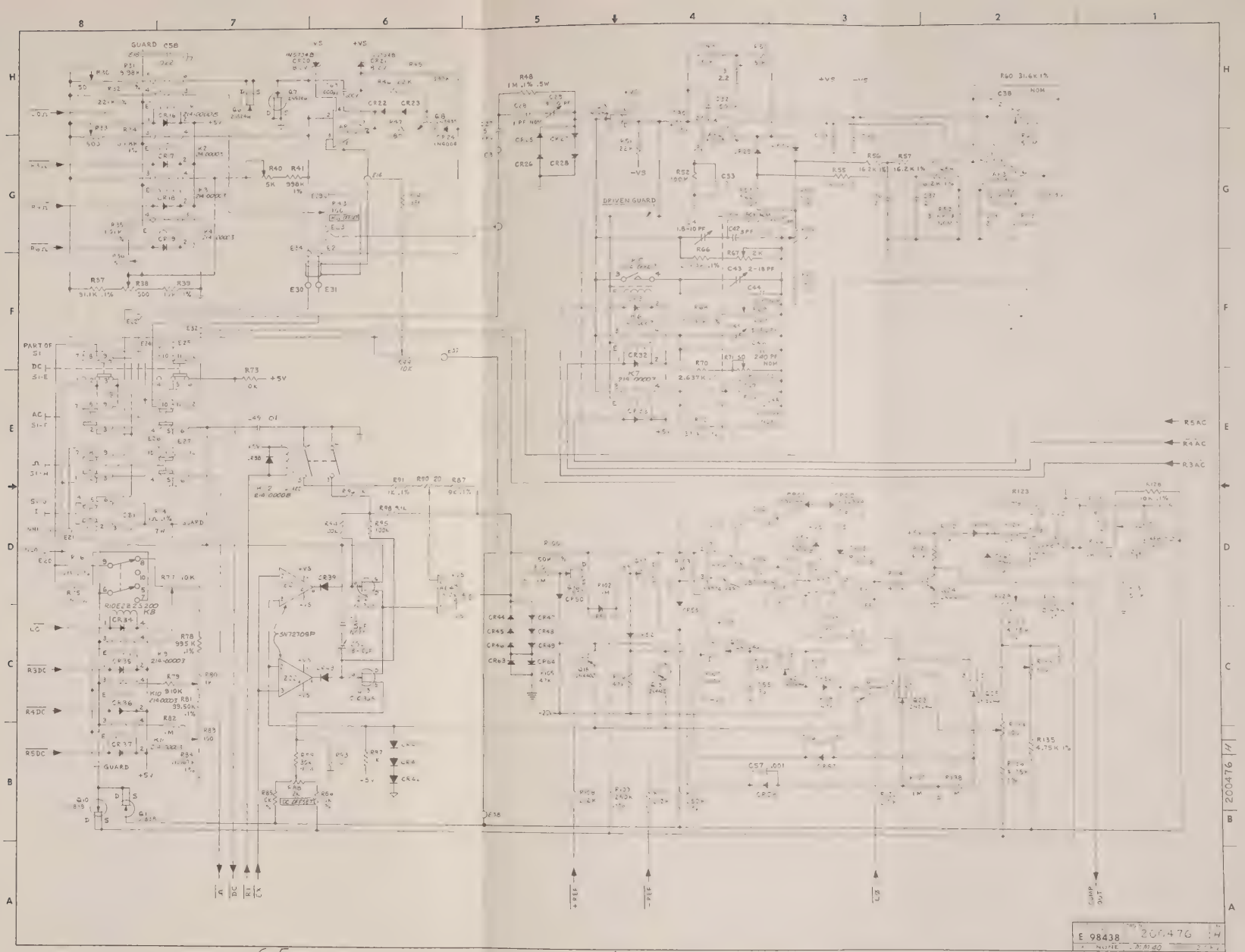
1. ALL RESISTORS ARE IN OHMS, ±5%, .25W.
2. ALL CAPACITORS ARE IN MICROFARADS.
3. PARTIAL REF DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A1.
4. DIODES ARE IN4148
5. ⏚ INDICATES DIGITAL COMMON
   ⏚ INDICATES ANALOG COMMON
   +5V INDICATES +5VDC POWER SUPPLY
   +VS INDICATES POSITIVE VOLTAGE SUPPLY
   −VS INDICATES NEGATIVE VOLTAGE SUPPLY
6. [illegible] IS A MATCHED REFERENCE SET.

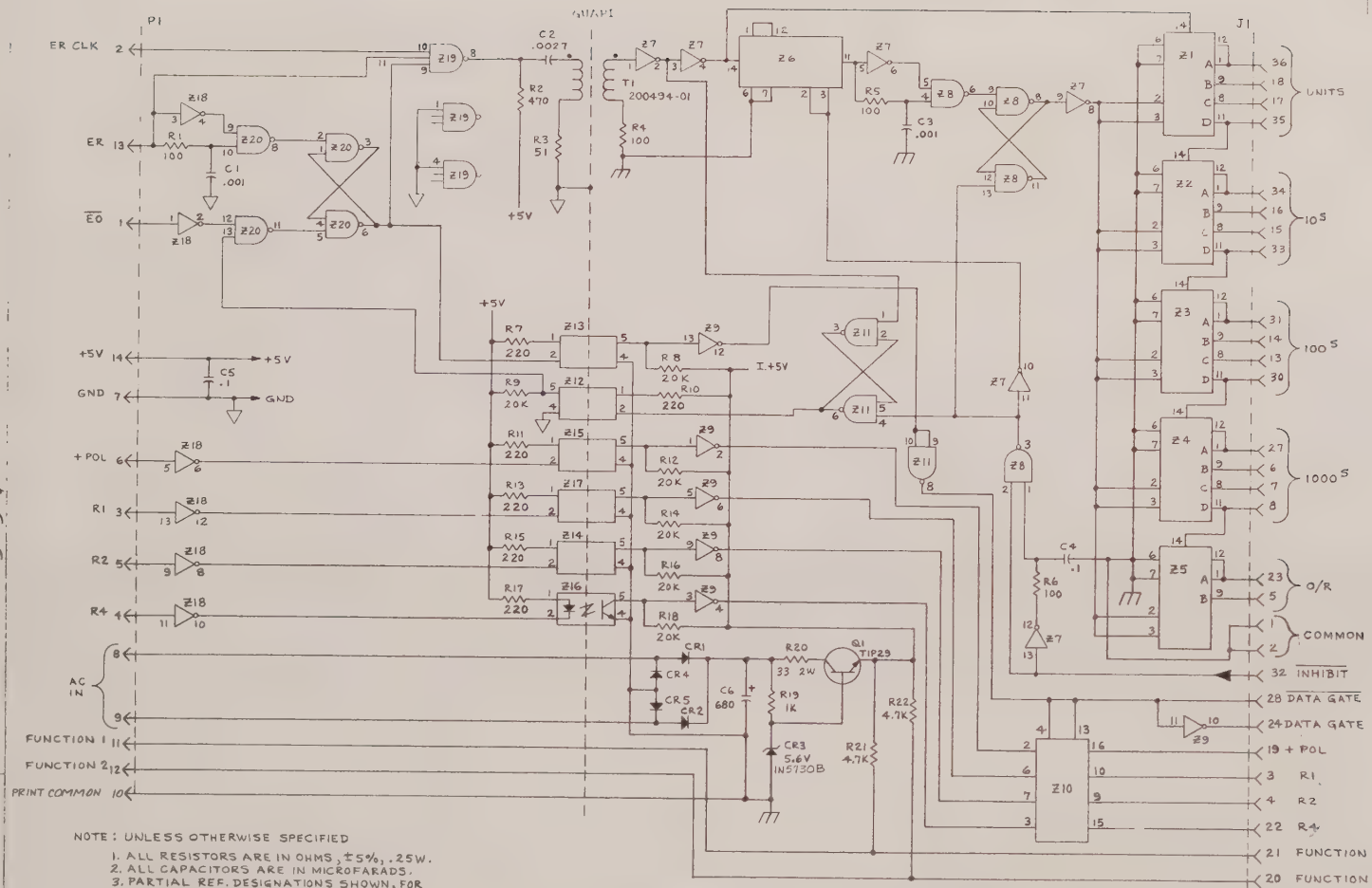
REF. DESIGNATION	P/N	+5V	GND	REF. DESIGNATION	P/N	+VS	-VS
Z1	A7R3849	24	12	Z18,19	SN7432N		
Z2,5,9,10,11,13,14,15	SN7400N	14	7	Z20	NE555V		
Z3	SN7490N	5	10	Z21,22	SN72709P		
Z4,7,23	SN7404N	14	7				
Z6	SN7486N	14	7				
Z8	SN7420N	14	7				
Z12	SN74192N	16	8				
Z16	SN7410N	14	7				
Z17	SN7440N	14	7				

—	200475	200460
DASH	NEXT ASSY	USED ON

SCHEMATIC - ANALOG/DIGITAL A2

E 98438


GUARD
DRIVEN GUARD
+5V
-5V
+VS
-VS
R48
1M .1% .5W
R60 31.6K 1%
R56 16.2K 1%
R57 16.2K 1%
R55 16.2K 1%
R66
R67 2K
R70
2.637K
R73
0K
R77 10K
R78
995K 1%
R79
R80
R81
39.50K 1%
R82
R83
150
R84
332R
R85
2K
R86
2K
R87
R88
R89
R90 20
R91
R95
102K
R98 9.1K
R123
R135
4.75K 1%
C38
C42 3PF
C43 2-18PF
C44
C57 .001
C33
CR22
CR23
CR26
CR28
CR32
CR39
CR44
CR45
CR46
CR47
CR48
CR63
CR64
SW78708P
PART OF S1
DC S1-E
AC S1-F
S1-H
S1-G
S1-I
R3DC
R4DC
R5DC
LC
R5AC
R4AC
R3AC
E 98438
200476



NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS, ±5%, .25W.
2. ALL CAPACITORS ARE IN MICROFARADS.
3. PARTIAL REF. DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A3
4. ALL DIODES ARE 1N4001

REF. DESIG	P/N	+5V	GND	REF. DESIG	P/N	+5V	GND
Z1-6	7-96040	5	10	Z10	7-96047	5	12
Z7,9,18	7-96075	14	7				
Z8,11,20	7-96049	14	7				
Z12-17	7-96116	—	—				
Z19	7-96100	14	7				

[redacted]

G.L. NICHOLSON 9/6/77

SCHEMATIC - DATA OUTPUT A3

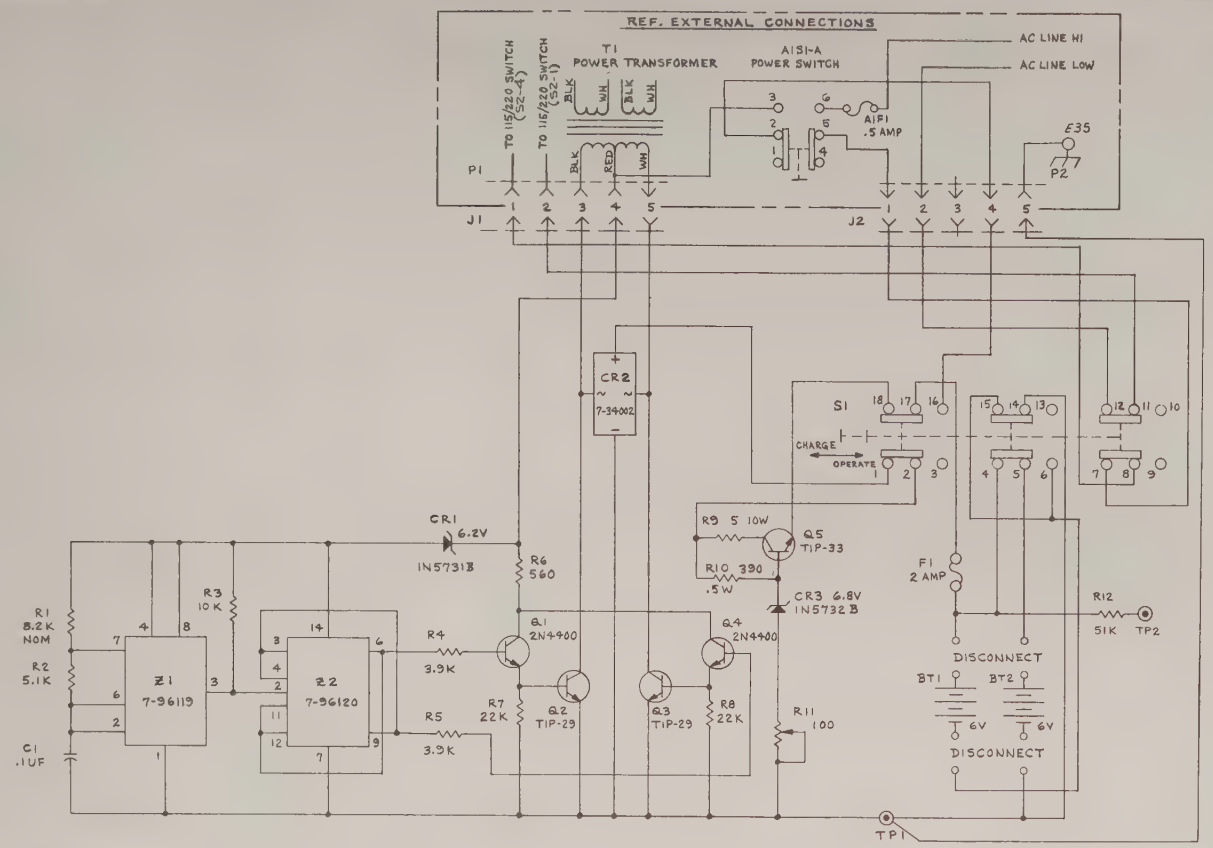
200480

200481 B

NONE

9-9

200481 3



NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS, ±5% AND .25W.
2. PARTIAL REF. DESIGNATION SHOWN. FOR COMPLETE DESIGNATOR, PREFIX WITH A4

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INC ECO 389	11/16/72	

ITEM NO	QTY REQD	DESCRIPTION	SCHEM DES	CIMRON PN	MFR OR VENDOR PN	CODE OR SPEC NO.

LIST OF MATERIAL

PART NO	QTY REQD	NEXT ASSEMBLY	USED ON
—	—	200485	200460

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ± DECIMALS .XX ± .030
ANGLES ± .XXX ± .010
SURFACE FINISH ✓
MATERIAL
FINISH

CONTRACT NO
DRAWN G.L. NICHOLSON 7/14/72
CHECKED
ENGINEER 11/1/73
APPROVED 3/5/73
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE 3/5/73

CIMRON

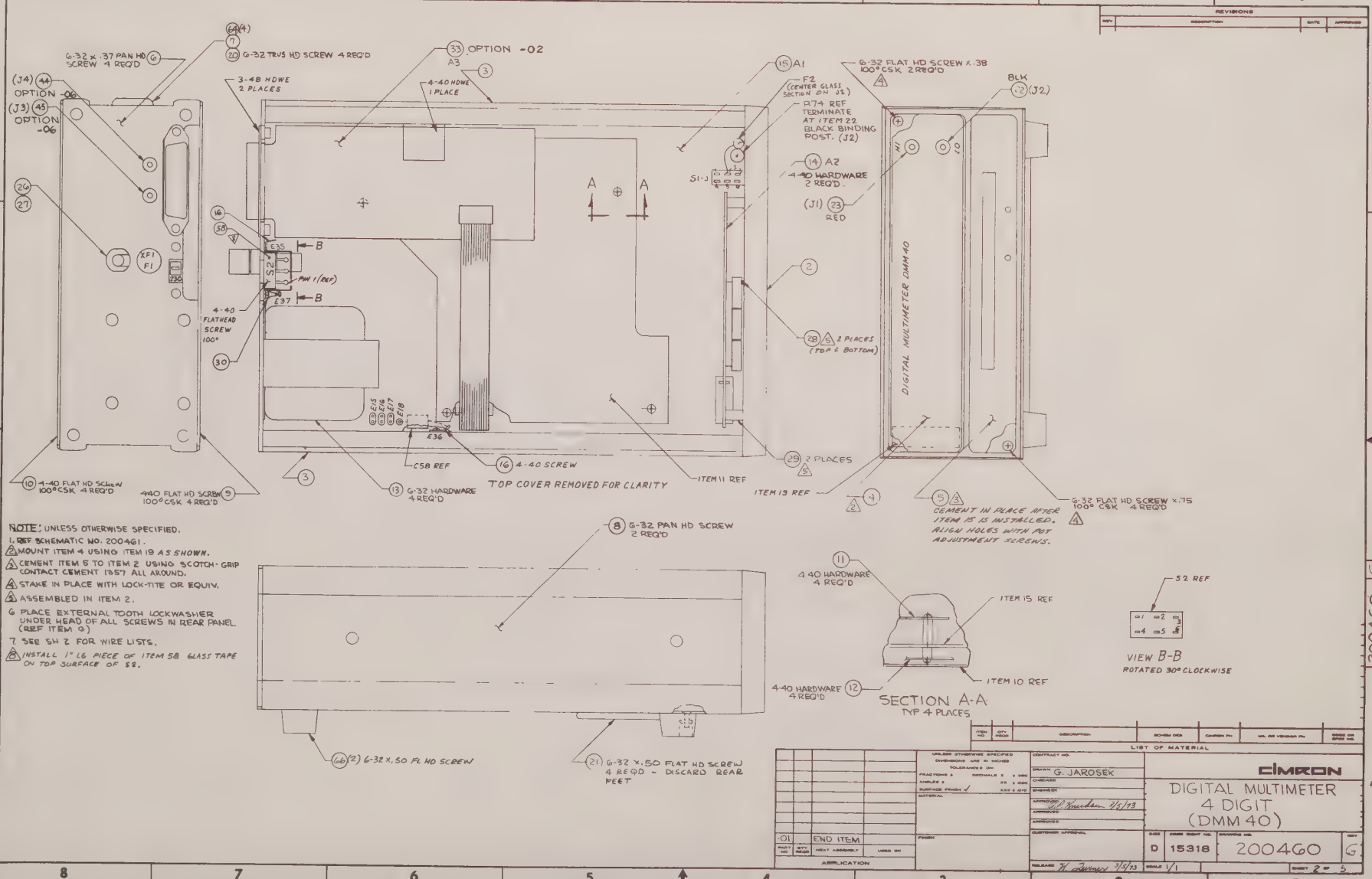
SCHEMATIC - BATTERY PACK A4

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	15318	200486	A

SCALE NONE SHEET 1 OF 1

200486 A1

6-7



NOTE: UNLESS OTHERWISE SPECIFIED.

1. REF SCHEMATIC NO. 200461.
2. MOUNT ITEM 4 USING ITEM 19 AS SHOWN.
3. CEMENT ITEM 5 TO ITEM 2 USING SCOTCH-GRIP CONTACT CEMENT 1357 ALL AROUND.
4. STAKE IN PLACE WITH LOCK-TITE OR EQUIV.
5. ASSEMBLED IN ITEM 2.
6. PLACE EXTERNAL TOOTH LOCKWASHER UNDER HEAD OF ALL SCREWS IN REAR PANEL. (REF ITEM 9)
7. SEE SH 2 FOR WIRE LISTS.
8. INSTALL 1" LG PIECE OF ITEM 58 GLASS TAPE ON TOP SURFACE OF S2.

REVISIONS

REV	DESCRIPTION	DATE	APPROVED

LIST OF MATERIAL

ITEM NO	QTY REQD	DESCRIPTION	SCHEM DES	CIMRON PN	MFR OR VENDOR PN	SOURCE OR SPEC NO.

-01	END ITEM		
PART NO	ASSY PROJ	NEXT ASSEMBLY	USED ON
APPLICATION			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ± DECIMALS X ± .060 XX ± .030 XXX ± .010
ANGLES ±
SURFACE FINISH √
MATERIAL
FINISH

CONTRACT NO.
DRAWN G. JAROSEK
CHECKED
ENGINEER
APPROVED J.L. Knudsen 3/6/73
APPROVED
CUSTOMER APPROVAL
RELEASE H. Jarosek 3/6/73

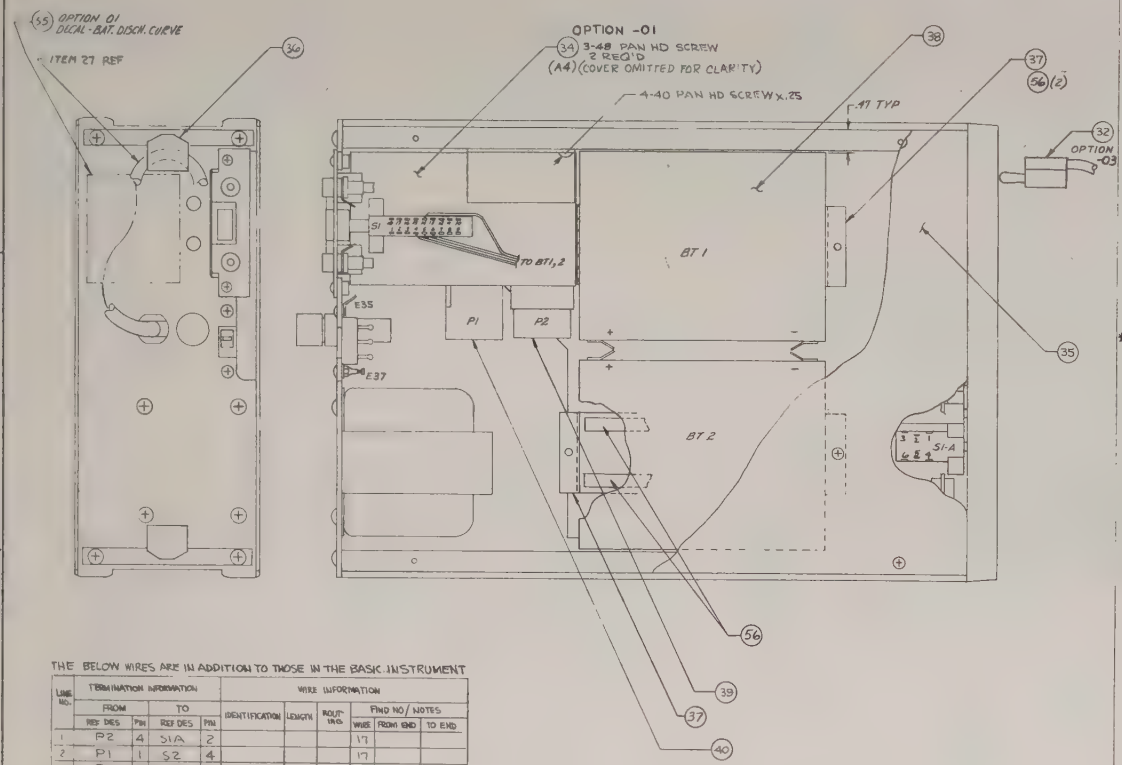
CIMRON

DIGITAL MULTIMETER 4 DIGIT (DMM 40)

SIZE	CAGE IDENT NO.	DRAWING NO.	REV
D	15318	200460	G

SCALE 1/1 SHEET 2 OF 5

200460 G



THE BELOW WIRES ARE IN ADDITION TO THOSE IN THE BASIC INSTRUMENT

LINE NO.	TERMINATION INFORMATION FROM REF DES	FROM PIN	TO REF DES	TO PIN	WIRE INFORMATION IDENTIFICATION	LENGTH	ROUTING	FIND NO./NOTES WIRE	FROM END	TO END
1	P2	4	S1A	2				17		
2	P1	1	S2	4				17		
3	P1	2	S2	1				17		
4	P1	3	E15					17		
5	P1	4	E16					17		
6	P1	5	E17					17		
7	S1A	3	E16					17		
8	A4S1	4	BT1	+	BT1+			17		
9	A4S1	5	BT2	+	BT2+			17		
10	A4S1	6	BT1	-	BT1-			17		
11	A4S1	14	BT2	-	BT2-			17		
12	P2	3	E35		GND			17		
* 16	P2-1		S1A	5						
* 21	P2-2		E37							

* IF PREVIOUSLY WIRED SEE BASIC INSTR. WIRE LIST FOR DELETION.

BATTERY PACK OPTION

WIRE LIST FOR BASIC INSTRUMENT

LINE NO.	TERMINATION INFORMATION FROM REF DES	FROM PIN	TO REF DES	TO PIN	WIRE INFORMATION IDENTIFICATION	LENGTH	ROUTING	FIND NO./NOTES WIRE	FROM END	TO END
1	T1-BRN		E10							
2	T1-RED		E6							
3	T1-ORG		E1							
4	T1-YEL		E7							
5	T1-GRN		E9							
6	T1-BLU		E12							
7	T1-VIO		E13							
8	T1-WHT		S2	4	2 COND SHLD- TIE SHIELD TO GND LUG (E35)					
9	T1-BLK		S2	6						
10	T1-WHT		S2	5	2 COND SHLD					
11	T1-BLK		S2	1						
12	T1-BLK		E15							
** 13	T1-RED		E16		3 COND SHLD					
14	T1-WHT		E17							
15	T1-BLK		E1							
* 16	S2	4	S1A	5	WHT			18	2 COND. SHLD.	
17	S1A	6	F1	B	BLK			18	TIE SHLD TO E35	
18	E37		WHT LEAD OF POWER CORD							
19	F1	A	BLK LEAD OF POWER CORD							
20	E35		GRN LEAD OF POWER CORD							
* 21	S2	1	E37					17		
22	J1		S1-J-2						SEE SHEET 2	
23	J2		E20					17		
24	S2	2	S2	6				BUSS		
25	T1-GRY		E1							
26										
27										
28	ADDITIONAL WIRING FOR REAR INPUT OPTION									
29	J1		J3		WHT			18	PIGTAIL TO	
30	J2		J4		BLK				J2	

* THESE TWO LINE NO. DELETED ON BATTERY PACK OPTION. SEE LINE NO.'S 16 & 21 OF BATTERY PACK OPTION.

** DISCONNECT FOR OPTION 02 (UNSOLDER WIRE AT E16, TIE BACK & INSULATE)

OPTION TABLE

OPTION		
01	BATTERY PACK	ADD ITEMS 34 THRU 42 AND COMPLETE THE WIRING PER OPTION WIRE LIST.
02	BCD DATA OUTPUT	ADD ITEM 33 AND MATE A3P1 WITH A1J2. ** (SEE ABOVE)
03	INPUT CABLE	ENCLOSE ITEM 32 WITH UNIT FOR SHIPMENT.
04	RACK MOUNTING BRACKET-SINGLE	ENCLOSE ONE EACH ITEMS 47 AND 48 WITH UNIT FOR SHIPMENT.
05	RACK MOUNTING BRACKET-DOUBLE	ENCLOSE (1) ITEM 50 AND (2) ITEMS 48, 49 & 51 WITH UNIT FOR SHIPMENT.
06	REAR INPUT TERMINALS	ADD ITEMS 44 AND 45. WIRE TO ITEMS 22 AND 23 PER REAR INPUT OPTION WIRING DATA.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

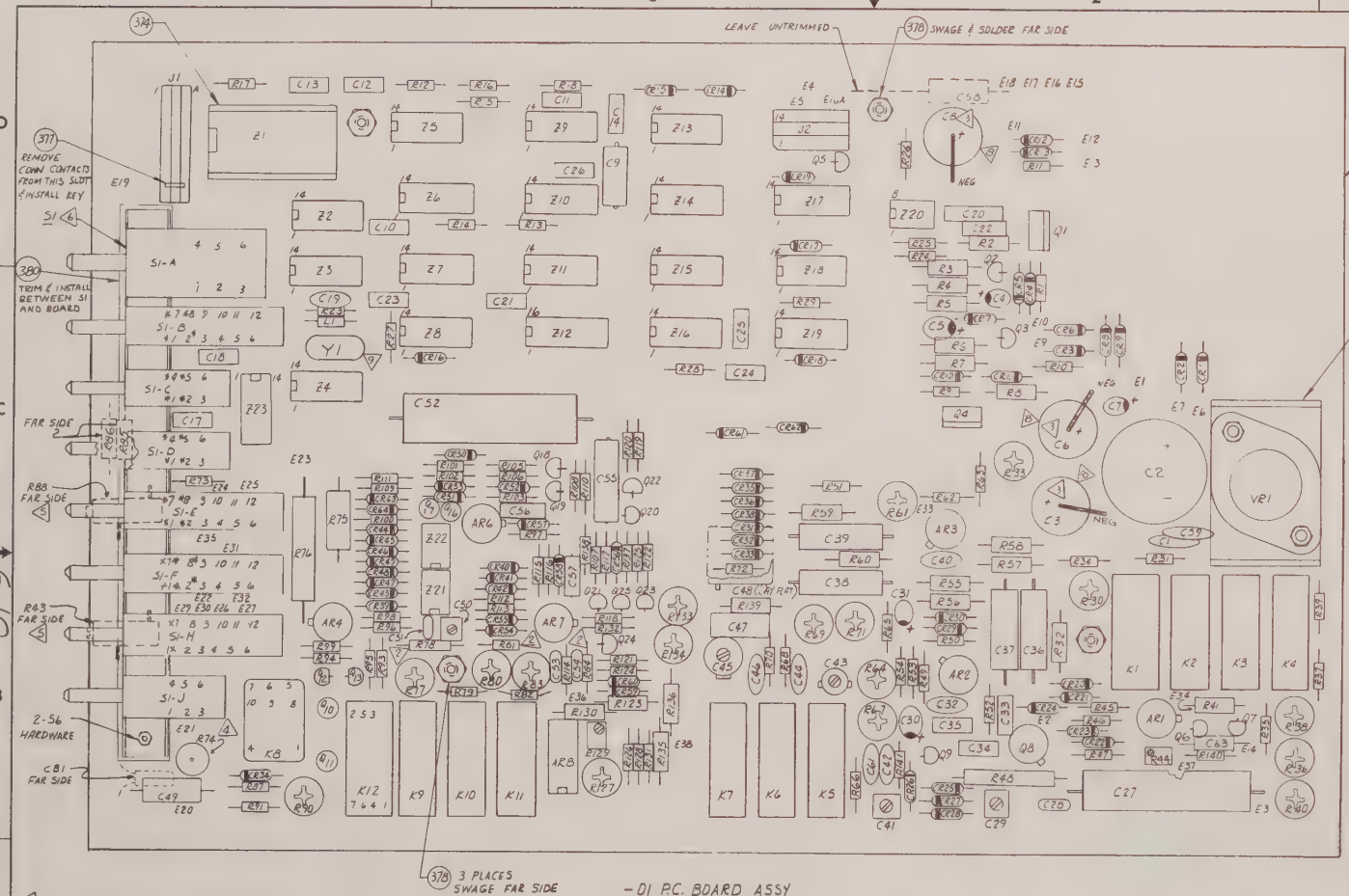
CIMRON DIVISION

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	15318	200460	G

SCALE | RELEASE | SHEET 3 OF 5

200460 G

69



WIRE TABLE (ROUTE FAR SIDE UNLESS NOTED OTHERWISE)

WIRE #	FROM	TO	REMARKS
1	E3	E22	PL ITEM 382
2		E23 (PIGTAIL)	
3	E2	E31 (WHT)	
4	E34	E30 (BLK)	PL ITEM 383
5	E4	E29 (PIGTAIL)	
6	E32	E33 (WHT)	PL ITEM 381
7	E11	E19 (RED)	PL ITEM 384 NEAR SIDE
8	E4	E27 (WHT)	
9	E5	E25 (RED)	PL ITEM 383
10	E16A	E24 & E26 (PIGTAIL)	
11	E35	E36 (GRN)	PL ITEM 385
12	E37	E38	PL ITEM 381

4 INSTALL PUSHBUTTONS ON SWITCH AFTER ASSY. CUT PINS MARKED * FLUSH TO 1/32 FROM SWITCH BODY TOP SIDE. CUT PINS MARKED X FLUSH TO 1/32 FROM SWITCH BODY, BOTTOM SIDE.

5 INSTALL R43 & R88 ON FAR SIDE OF BOARD AS SHOWN. BEND REAR TWO PINS FLAT & SOLDER TO PADS PROVIDED.

4 INSTALL R74 IN A VERTICAL POSITION, .12 OFF OF P.C. BOARD. LEAVE TOP LEAD UNSOLDERED.

3 SLEEVE TOP LEADS OF C3, 6, & 8 USING TEFLON SLEEVING

4 R74, 78, 81 & 84 ARE PART OF MATCHED SET 200498-01. FOR SCHEMATIC DIAGRAM, SEE E200476.

NOTES: (UNLESS OTHERWISE SPECIFIED)

-01 P.C. BOARD ASSY

COMPONENT SIDE SHOWN
(TOP CLAD DELETED FOR CLARITY)

6 ADD ITEM #391 SPACER UNDER Y1 BEFORE SOLDERING.

6 ADD ITEM #390 WASHER UNDER C3, C6, & C8. (USE THERMATE OR OTHER SUITABLE STICKY SUBSTANCE TO ATTACH WASHER TO CAP. BEFORE INSTALLATION & INSURE CAP. IS WELL SEATED ON P.C. BOARD BEFORE SOLDERING.)

7. PARTIAL REF. DES. ARE SHOWN. FOR COMPLETE DESIGNATOR. PREFIX WITH "A1".

-01 PARTS LIST SEE SHEETS 3 THRU 13.

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

DIM IN INCHES TOLERANCES .XXX ± .010 .XX ± .03 .X ± .06° BREAK ALL SHARP CORNERS & EDGES MACH SURFACES √

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DWG SIZE D

TITLE: ANALOG/DIGITAL P.C. BOARD ASSEMBLY A1

CALIFORNIA INSTRUMENTS CORP SAN DIEGO, CALIFORNIA

MODEL DMM 40 | CONTRACT NO | CODE IDENT 16067

RELEASE | CHECKER | PURCHASING | DWG NO. D200475 | REV J

DESIGN | PROJ ENGR | SCALE 2X | SHEET 2 OF 13

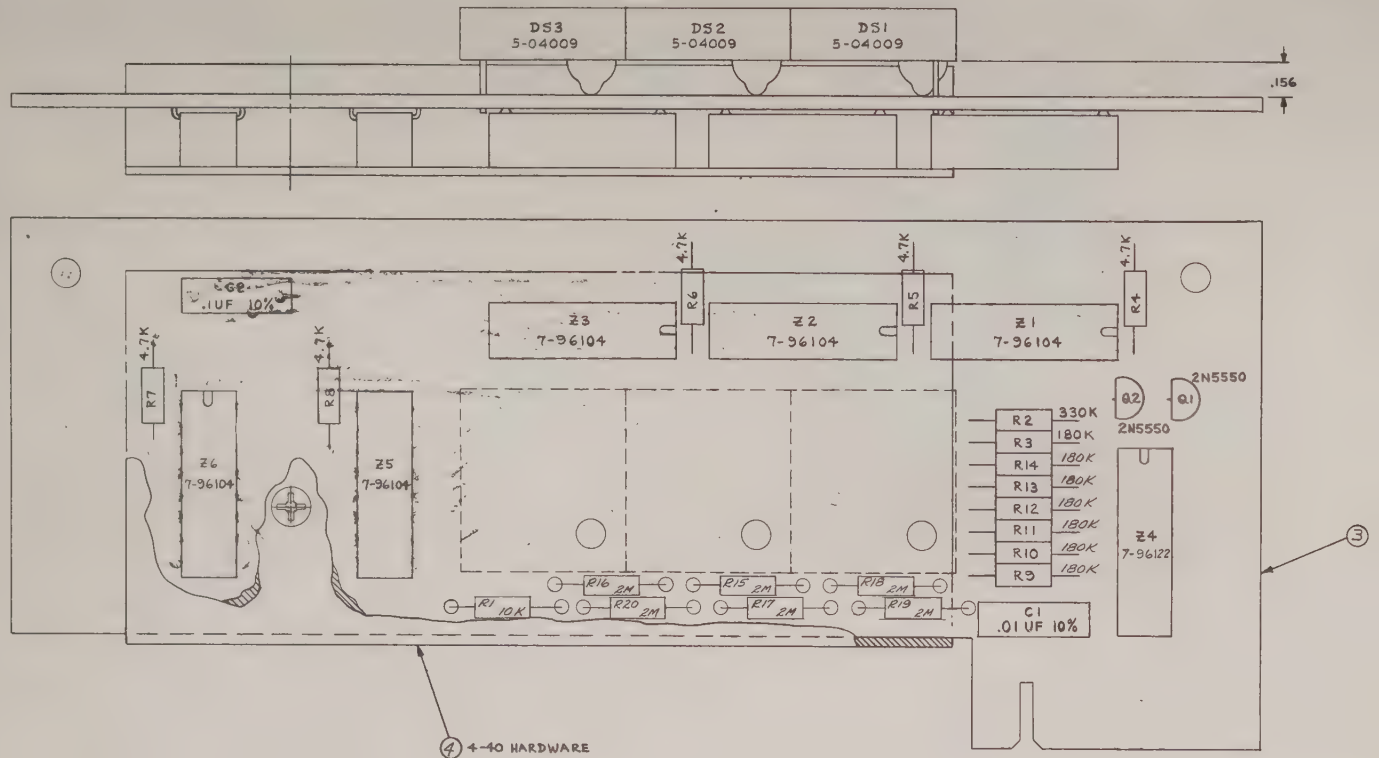
DRFTSMN M. Martin 12-20-73 | CHF ENGR

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH
-01	1	200460	DMM40	

REVISIONS

REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

D200475



3. FOR SCH. SEE 200476
2. PARTIAL REF. DESIGNATIONS SHOWN. FOR COMPLETE DESIGNATOR, PREFIX WITH A2
1. ALL RESISTORS ARE IN OHMS, ±5%, .25W.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

PART NO	QTY REQD	NEXT ASSEMBLY	USED ON
-01	1	200460	DMM40

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± DECIMALS X ± .050
ANGLES ± XX ± .020
SURFACE FINISH ✓ XXX ± .010
MATERIAL
FINISH

CONTRACT NO
DRAWN G. L. NICHOLSON 11/6/72
CHECKED
ENGINEER
APPROVED 12/4/72
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE 11/17/72

CIMRON DIVISION

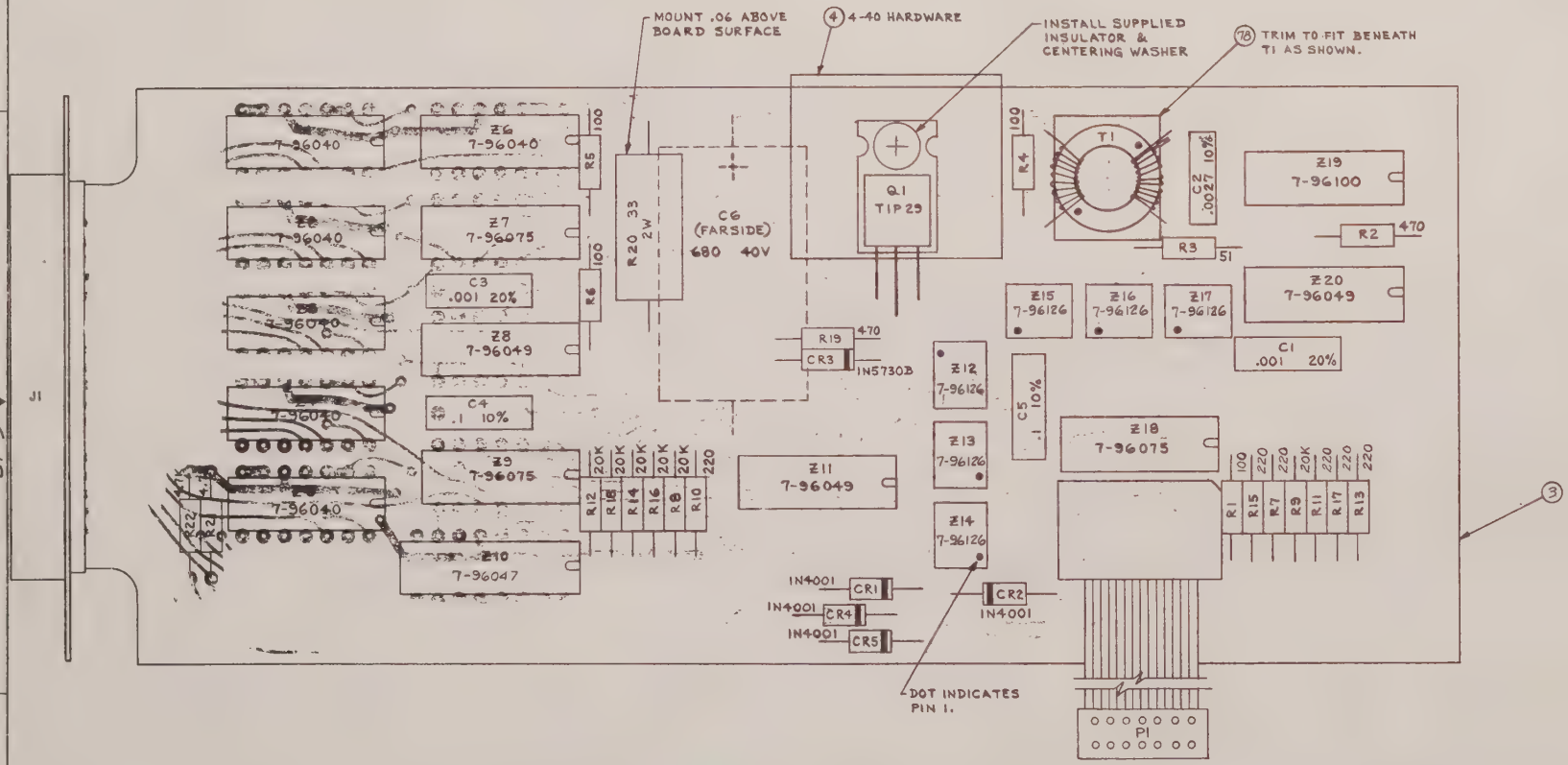
BOARD ASSY-
DISPLAY
A2

SIZE	CODE IDENT NO	DRAWING NO	REV
D	15318	200470	C

SCALE 4/1 SHEET 2 OF 4

11-9

200470 C



SEE SEPARATE PARTS LIST.

4 REF. SCHEMATIC DWG. 200481.
3. PARTIAL REF. DESIGNATIONS SHOWN. FOR COMPLETE DESIGNATOR, PREFIX WITH A3
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE IN OHMS, ± 5%, .25W.

PART NO	QTY REQD	NEXT ASSEMBLY	USED ON
-01	1	200460	DMM40

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
FRACTIONS ± DECIMALS X ± .050
ANGLES ± XX ± .010
SURFACE FINISH ✓ XXX ± .010
MATERIAL
FINISH

CONTRACT NO
DRAWN G.L. Nicholson 10/3/72
CHECKED
ENGINEER
APPROVED
APPROVED
APPROVED R.T. Knudsen 10/4/72
CUSTOMER APPROVAL
RELEASE W. Swanson 10/4/72

CIMRON DIVISION

ASSEMBLY - DATA OUTPUT - A3

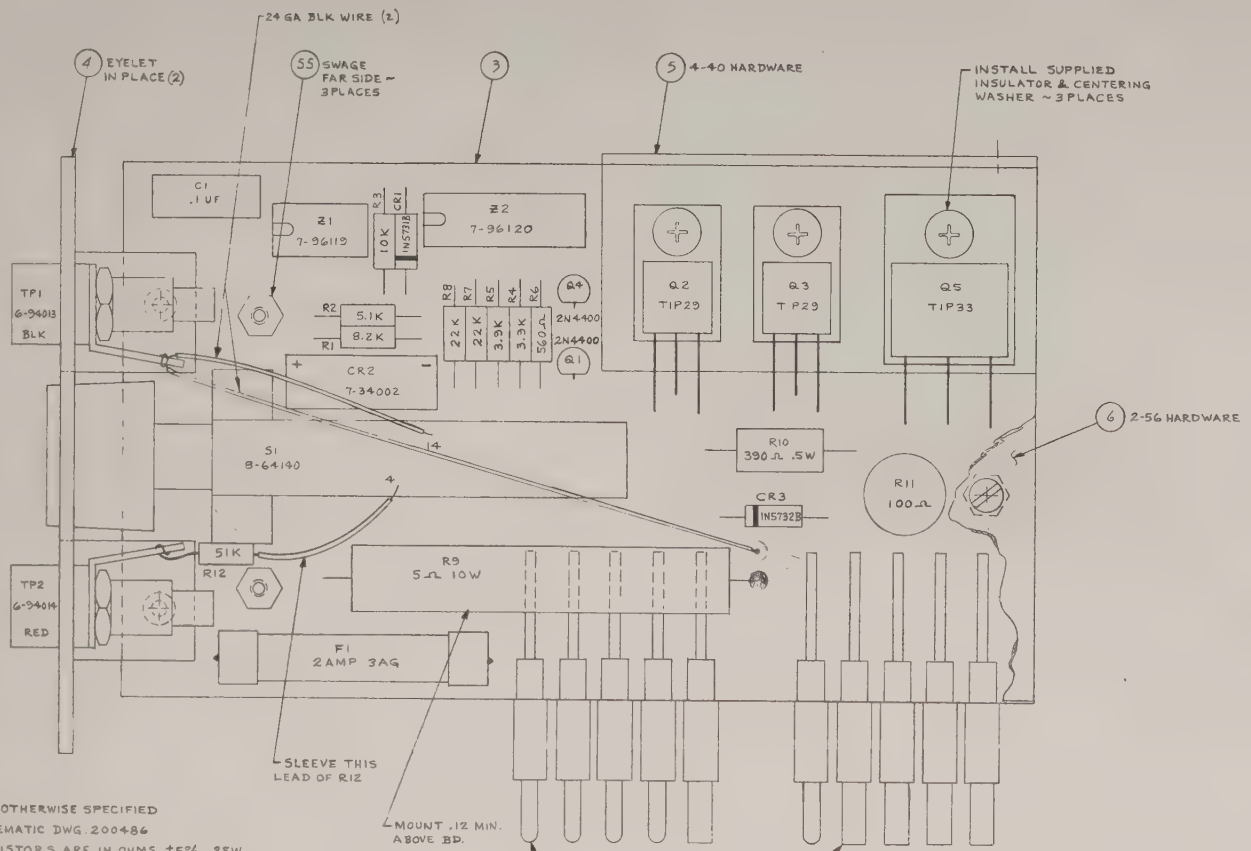
SIZE	CODE IDENT NO.	DRAWING NO	REV
D	15318	200480	C

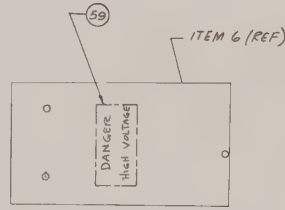
SCALE 4/1 SHEET 2 OF 3

21-6

200480 C

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
	SEE SHT 1		





TOP VIEW ITEM 6
LOCATE ITEM 59 IN APPROX LOCATION SHOWN
SCALE 1 : 1

NOTE: UNLESS OTHERWISE SPECIFIED
1. REF. SCHEMATIC DWG. 200486
2. ALL RESISTORS ARE IN OHMS, ±5%, .25W.
3. PARTIAL REF. DESIGNATIONS SHOWN. FOR COMPLETE DESIGNATOR, PREFIX WITH A4.
4 ALIGN CONTACTS USING MATING CONNECTORS.

SEE SEPARATE PARTS LIST

PART NO	QTY ATQO	NEXT ASSEMB.	USED ON
-01	1	200460	DMA-40

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± DECIMALS X ± .050
ANGLES ± .XX ± .030
SURFACE FINISH √ .XXX ± .010
MATERIAL
FINISH

CONTRACT NO
DRAWN G.L. NICHOLSON 4/4/72
CHECKED
ENGINEER
APPROVED
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE

CIMRON DIVISION

ASSEMBLY - BATTERY PACK A4

SIZE	CODE IDENT NO	DRAWING NO	REV
D	15318	200485	C

SCALE 4:1 SHEET 2 OF 4

200485 C

REPLACEMENT PARTS

7.1 GENERAL

This section contains ordering information and complete list of replaceable parts. Parts are listed by major assembly in alphanumerical order of their reference designators. Description, manufacturers' part number, manufacturers' code ident number (see Appendix A for list of manufacturers), and CALIFORNIA INSTRUMENTS stock numbers are indicated.

7.2 ORDERING INFORMATION

In order to provide our customers with prompt service on replacement parts, please provide the following information, when applicable, for each part ordered:

a) Model number and serial number of the instrument,

b) CALIFORNIA INSTRUMENTS part number of the subassembly where component is located,

c) Component reference designator,

d) Component description,

e) Component manufacturers' number and code ident,

f) CALIFORNIA INSTRUMENTS stock number.

All replacement parts orders should be placed with CALIFORNIA INSTRUMENTS COMPANY, a division of Aiken Industries, San Diego, California, 92111.

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	200460-1	MULTIMETER - BASIC	16067	--	--
					--
					1
	200462-01	BEZEL - FRONT PANEL	16067	1-10438	2
	200463-01	PANEL - SIDE	16067	1-10439	3
	200464-01	PANEL - FRONT, UPPER	16067	1-10440	4
	200465-01	PANEL - FRONT, LOWER	16067	1-10441	5
	200832-01	PANEL - REAR	16067	1-10442	6
	200467-01	PANEL - SIDE TRIM	16067	1-10443	7
	200467-02	PANEL - SIDE TRIM	16067	1-10444	8
	200468-01	COVER - TOP	16067	1-10445	9
	200469-01	COVER - BOTTOM	16067	1-10446	10
	200473-01	SHIELD - GUARD, TOP	16067	1-10447	11
	200474-01	SHIELD - GUARD, BOTTOM	16067	1-10448	12
T1	200493-01	TRANSFORMER	16067	7-10262	13
A2	200470-01	BOARD ASSY - DISPLAY	16067	--	14
A1	200475-01	BOARD ASSY - ANALOG/DIG.	16067	--	15
E35, E36	1412-6	TERMINAL, SOLDER	83330	2-50223	16
	MIL-W-16878D/C-24	WIRE, INS. - 24 AWG, WHT	81349		17
	MIL-W-16878D/C-24(19)	N-S2V WIRE - 2 COND SHLD	81349		18
	10H	FOAM TAPE .03THK x .75	88216		19
	184-5050	HANDLE	a.m.handle	2-10504	20
	MP40008-2	BAIL, INSTRUMENT	21604	2-10503	21
J2	221-BLK	BANANA JACK - BLK	83330	2-50214	22
J1	221-RED	BANANA JACK - RED	83330	2-50215	23
XF1	342-004	FUSE HOLDER	75915	2-40264	24
F1	313.250	FUSE 3AG, 1/4 A S.B.	75915	2-40258	25
	SR-6P-1	GROMMET, STRAIN RELIEF	28520	2-40206	26
	2-70004	POWER CORD ASSY	16067	2-50218	27
	1/16 DIA x 3/16 LG	SPRING PIN	73734	2-10314	28
	9628B-B-0440	SPACER - THD	06540	2-10520	29
E37	3650-1	TERMINAL - TURRET	71279	2-50217	30
S2	46206LF	SWITCH - SLIDE DPDT	82389	2-40298	31
	OPTION (03)	INPUT CABLE SEE PL 200503-01			32
	OPTION (02)	DATA OUTPUT SEE PL 200480-01			33
	OPTION (01)	BATTERY PACK SEE PL 200501-01			34

MODEL DMM40-BASIC | CALICO P/N 200460 | ASSY R.D.

TITLE DIGITAL MULTIMETER - 4 DIGIT | SHT 4 OF 5

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	OPTION (01)	BATTERY PACK SEE PL 200501-01			35
	OPTION	BATTERY PACK SEE PL 200501-01			36
	OPTION	BATTERY PACK SEE PL 200501-01			37
	OPTION	BATTERY PACK SEE PL 200501-01			38
	OPTION	BATTERY PACK SEE PL 200501-01			39
	OPTION	BATTERY PACK SEE PL 200501-01			40
	OPTION	BATTERY PACK SEE PL 200501-01			41
	OPTION	BATTERY PACK SEE PL 200501-01			42
					43
J3	OPTION (06)	REAR INPUT SEE PL 200506-01			44
J4	OPTION	REAR INPUT SEE PL 200506-01			45
					46
	OPTION	OPTION 04			47
	OPTION	SINGLE RACK MTG. SEE PL 200504-01			48
	OPTION				49
	OPTION	OPTION 05			50
	OPTION	DUAL RACK MTG. SEE PL 200505-01			51
					52
					53
					54
	OPTION 01	BATTERY PACK SEE PL 200501-01			55
	OPTION 01				56
					57
	#212 - 3/4W	TAPE, GLASS CLOTH	99742		58
					59
REF	323.125 *	FUSE 1/8A S.B.	75915	2-70061	60
	*	FOR 230V VERSIONS ONLY			61
F2	318003	FUSE 3A	75915	2-70062	62
					63
	6-32 x 3/8	SCREW, TRUSS HD			64
					65
	2091	RUBBER FEET	08065	2-10146	66
					67
					68
					69
					70

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TITLE DIGITAL MULTIMETER - 4 DIGIT | SHT 5 OF 5

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1	200475-01	ANALOG/DIGITAL BOARD ASSY	16067	--	1
					2
	200477-02	P.C. BOARD	16067	1-60218	3
					4
					5
A1AR1	CIC 230-6	AMPLIFIER (BLU DOT)	16067	3-60039	6
A1AR2	LM 301A	AMPLIFIER	27014	3-60021	7
A1AR3	LM 301A	AMPLIFIER	27014	3-60021	8
A1AR4	CIC 230-4	AMPLIFIER (YEL DOT)	16067	3-60037	9
A1AR5		NOT USED			10
A1AR6	741HC	AMPLIFIER	07263	3-60066	11
A1AR7	709HC	AMPLIFIER	07263	3-60067	12
A1AR8	LM 747CN	AMPLIFIER	01295	3-60060	13
					14
					15
					16
A1C1	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	17
A1C2	23C15TT43	CAPACITOR 4000μF 15V	99392	6-10938	18
A1C3	ET681X040A03	CAPACITOR 680μF 40V	73445	6-10928	19
A1C4	T362B685M025AS	CAPACITOR 6.8μF 25V	05397	6-10932	20
A1C5	T362C336M015AS	CAPACITOR 33μF 15V	05397	6-10933	21
A1C6	ET681X040A03	CAPACITOR 680μF 40V	73445	6-10928	22
A1C7	T362B685M025AS	CAPACITOR 6.8μF 25V	05397	6-10932	23
A1C8	C436AR/N25	CAPACITOR 25μF 300V	73445	6-10934	24
A1C9	C280AE/A220K	CAPACITOR .22μF 250V	73445	6-10881	25
A1C10	C350AG/P1KCF	CAPACITOR .001μF 630V	73445	6-10925	26
A1C11	C350AG/P1KCF	CAPACITOR .001μF 630V	73445	6-10925	27
A1C12	C280AE/A10K	CAPACITOR .01μF 250V	73445	6-10929	28
A1C13	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	29
A1C14	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	30
A1C15		NOT USED			31
A1C16		NOT USED			32
A1C17	C280AE/A68K	CAPACITOR .068μF 250V	73445	6-10937	33
A1C18	C280AE/A68K	CAPACITOR .068μF 250V	73445	6-10937	34
A1C19	CM05F271F03	CAPACITOR 270pF 1%	81349	6-10040	35
A1C20	C280AE/A220K	CAPACITOR .22μF 250V	73445	6-10881	36

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TITLE ANALOG/DIGITAL BOARD ASSY.	SHT 3 OF 13	

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REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1C21	C280AE/A100K	CAPACITOR .1μF	73445	6-10916	37
A1C22	C280AE/A10K	CAPACITOR .01μF	73445	6-10929	38
A1C23	C280AE/A10K	CAPACITOR .01μF	73445	6-10929	39
A1C24	C280AE/A10K	CAPACITOR .01μF	73445	6-10929	40
A1C25	C280AE/A10K	CAPACITOR .01μF	73445	6-10929	41
A1C26	C280AE/A100K	CAPACITOR .1μF	73445	6-10916	42
A1C27	ZA2J504K	CAPACITOR .5μF 1000V	27556	6-10915	43
A1C28	CM05CD010D03	CAPACITOR 1pF 500V	81349	6-10905	44
A1C29	222-809-05002	CAPACITOR VAR. 1.8-10pF	73445	6-10940	45
A1C30	T362C336M015AS	CAPACITOR 33μF 15V	05397	6-10933	46
A1C31	T362A225M020AS	CAPACITOR 2.2μF 20V	05397	6-10941	47
A1C32	DM15-151J	CAPACITOR 150pF 500V	72136	6-10030	48
A1C33	C280AE/A10K	CAPACITOR .01μF	73445	6-10929	49
A1C34	C280AE/A100K	CAPACITOR .1μF	73445	6-10916	50
A1C35	C280AE/A100K	CAPACITOR .1μF	73445	6-10916	51
A1C36	C5A205J	CAPACITOR 2μF 50V	12406	6-10942	52
A1C37	C5A205J	CAPACITOR 2μF 50V	12406	6-10942	53
A1C38	C5A205J	CAPACITOR 2μF 50V	12406	6-10942	54
A1C39	C5A205J	CAPACITOR 2μF 50V	12406	6-10942	55
A1C40	DM15-300J	CAPACITOR 30pF 500V	72136	6-10263	56
A1C41	222-809-05002	CAPACITOR VAR. 1.8-10pF	73445	6-10940	57
A1C42	DM15-030D	CAPACITOR 3pF 500V	72136	6-10549	58
A1C43	HT10KA/218	CAPACITOR VAR. 2-18pF	73445	6-10943	59
A1C44	DM15-100J	CAPACITOR 10pF 500V	72136	6-10004	60
A1C45	HT10MA/550	CAPACITOR VAR. 5-50pF	73445	6-10919	61
A1C46	CM05F241J03	CAPACITOR 240pF 500V	81349	6-10284	62
A1C47	DM	CAPACITOR T.B.D.			63
A1C48	DM30-912F	CAPACITOR 9100pF 1%	72136	6-10944	64
A1C49	PA2B103J	CAPACITOR .01μF 100V	27556	6-10945	65
A1C50	222-809-05002	CAPACITOR VAR. 1.8-10pF	73445	6-10940	66
A1C51	DM15-050D	CAPACITOR 5 pF 500V	72136	6-10483	67
A1C52	PA2A684K	CAPACITOR .68μF 50V 10%	27556	6-10880	68
A1C53	DM15-050D	CAPACITOR 5pF 500V	72136	6-10483	69
A1C54	DM15-220J	CAPACITOR 22pF 500V	72136	6-10260	70
A1C55	C280AF/A330K	CAPACITOR .33μF	73445	6-10946	71
A1C56	C350AG/P1KCF	CAPACITOR .001μF	73445	6-10925	72

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TITLE ANALOG/DIGITAL BOARD ASSEMBLY	SHT 4 OF 13	A1

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1C57	C350AG/P1KCP	CAPACITOR .001μF	73445	6-10925	73
A1C58	BA2G223	CAPACITOR .022μF 600V	27556	6-10947	74
A1C59	CK104	CAPACITOR .1μF 50V	71590	6-10129	75
A1C60	NOT USED				76
A1C61	DM15-050D	CAPACITOR 5pF 500V	72136	6-10483	77
A1C62	NOT USED				78
A1C63	SX-210	CAPACITOR 1000pF 600V	90201	6-10910	79
					80
A1CB1	MB332	CIRCUIT BREAKER, 3A	80368	2-70047	81
					82
					83
A1CR1	1N4001	DIODE	77638	3-10172	84
A1CR2	1N4001	DIODE	77638	3-10172	85
A1CR3	1N4148	DIODE	25403	3-10227	86
A1CR4	1N4148	DIODE	25403	3-10227	87
A1CR5	1N4148	DIODE	25403	3-10227	88
A1CR6	1N4148	DIODE	25403	3-10227	89
A1CR7	1N5731B	DIODE, ZENER	25403	3-10235	90
A1CR8	1N4148	DIODE	25403	3-10227	91
A1CR9	1N4148	DIODE	25403	3-10227	92
A1CR10	1N4148	DIODE	25403	3-10227	93
A1CR11	1N4148	DIODE	25403	3-10227	94
A1CR12	1N4004	DIODE	77638	3-10062	95
A1CR13	1N4004	DIODE	77638	3-10062	96
A1CR14	1N4148	DIODE	25403	3-10227	97
A1CR15	1N4148	DIODE	25403	3-10227	98
A1CR16	1N4148	DIODE	25403	3-10227	99
A1CR17	1N4148	DIODE	25403	3-10227	100
A1CR18	1N4148	DIODE	25403	3-10227	101
A1CR19	1N4148	DIODE	25403	3-10227	102
A1CR20	1N5734B	DIODE, ZENER	25403	3-10238	103
A1CR21	1N5734B	DIODE, ZENER	25403	3-10238	104
A1CR22	1N4148	DIODE	25403	3-10227	105
A1CR23	1N4148	DIODE	25403	3-10227	106
A1CR24	1N4004	DIODE	77638	3-10062	107
A1CR25	1N4148	DIODE	25403	3-10227	108

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REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1CR26	1N4148	DIODE	25403	3-10227	109
A1CR27	1N4148	DIODE	25403	3-10227	110
A1CR28	1N4148	DIODE	25403	3-10227	111
A1CR29	1N4148	DIODE	25403	3-10227	112
A1CR30	1N4148	DIODE	25403	3-10227	113
A1CR31	1N4148	DIODE	25403	3-10227	114
A1CR32	1N4148	DIODE	25403	3-10227	115
A1CR33	1N4148	DIODE	25403	3-10227	116
A1CR34	1N4148	DIODE	25403	3-10227	117
A1CR35	1N4148	DIODE	25403	3-10227	118
A1CR36	1N4148	DIODE	25403	3-10227	119
A1CR37	1N4148	DIODE	25403	3-10227	120
A1CR38	1N4148	DIODE	25403	3-10227	121
A1CR39	1N4148	DIODE	25403	3-10227	122
A1CR40	1N4148	DIODE	25403	3-10227	123
A1CR41	1N4148	DIODE	25403	3-10227	124
A1CR42	1N4148	DIODE	25403	3-10227	125
A1CR43	1N4148	DIODE	25403	3-10227	126
A1CR44	1N4148	DIODE	25403	3-10227	127
A1CR45	1N4148	DIODE	25403	3-10227	128
A1CR46	1N4148	DIODE	25403	3-10227	129
A1CR47	1N4148	DIODE	25403	3-10227	130
A1CR48	1N4148	DIODE	25403	3-10227	131
A1CR49	1N4148	DIODE	25403	3-10227	132
A1CR50	1N4148	DIODE	25403	3-10227	133
A1CR51	1N4148	DIODE	25403	3-10227	134
A1CR52	1N4148	DIODE	25403	3-10227	135
A1CR53	1N4148	DIODE	25403	3-10227	136
A1CR54	1N5731B	DIODE, ZENER	25403	3-10235	137
A1CR55	1N5731B	DIODE, ZENER	25403	3-10235	138
A1CR56	1N4148	DIODE	25403	3-10227	139
A1CR57	1N4148	DIODE	25403	3-10227	140
A1CR58	1N4148	DIODE	25403	3-10227	141
A1CR59	1N4148	DIODE	25403	3-10227	142
A1CR60	CIC 709-1	DIODE, REF SET (BRN DOT)	16067	3-10225	143
A1CR61	1N5234A	DIODE, ZENER	04713	3-10130	144

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REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1CR62	1N5234A	DIODE, ZENER	04713	3-10130	145
A1CR63	1N4148	DIODE	25403	3-10227	146
A1CR64	1N4148	DIODE	25403	3-10227	147
A1J1	G05D22A2BB1L	CONNECTOR	71468	4-10215	148
A1J2	CA-14S-TSD	SOCKET, 14 PIN D.I.P.	52072	2-30056	149
					150
					151
A1K1	214-00008	RELAY, REED	31951	2-45127	152
A1K2	214-00003	RELAY, REED	31951	2-45126	153
A1K3	214-00003	RELAY	31951	2-45126	154
A1K4	214-00003	RELAY	31951	2-45126	155
A1K5	214-00003	RELAY	31951	2-45126	156
A1K6	214-00003	RELAY	31951	2-45126	157
A1K7	214-00003	RELAY	31951	2-45126	158
A1K8	R10E2Z2S200	RELAY, P.C. MTG	24796	2-45129	159
A1K9	214-00003	RELAY	31951	2-45126	160
A1K10	214-00003	RELAY	31951	2-45126	161
A1K11	214-00003	RELAY	31951	2-45126	162
A1K12	214-00008	RELAY, REED	31951	2-45127	163
					164
					165
A1L1	DD 100	CHOKE, 100μH	43543	5-90057	166
					167
					168
A1Q1	T1P29	TRANSISTOR	01295	3-30241	169
A1Q2	2N4400	TRANSISTOR	81349	3-30257	170
A1Q3	2N4402	TRANSISTOR	27014	3-30259	171
A1Q4	T1P30	TRANSISTOR	01295	3-30250	172
A1Q5	2N4400	TRANSISTOR	81349	3-30257	173
A1Q6	2N5246	TRANSISTOR	01295	3-30243	174
A1Q7	2N5246	TRANSISTOR	01295	3-30243	175
A1Q8	2N3439	TRANSISTOR	81349	3-30244	176
A1Q9	2N5246	TRANSISTOR	01295	3-30243	177
A1Q10	U1898	TRANSISTOR, FET	15818	3-30217	178
A1Q11	U1898	TRANSISTOR, FET	15818	3-30217	179
A1Q12	CIC 365	TRANSISTOR, FET	16067	3-30245	180

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CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

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PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1Q13	CIC 365	TRANSISTOR, FET	16067	3-30245	181
A1Q14		NOT USED			182
A1Q15		NOT USED			183
A1Q16	U1897	TRANSISTOR, FET	15818	3-30260	184
A1Q17	U1897	TRANSISTOR, FET	15818	3-30260	185
A1Q18	2N4402	TRANSISTOR	27014	3-30259	186
A1Q19	2N4402	TRANSISTOR	27014	3-30259	187
A1Q20	2N5246	TRANSISTOR	01295	3-30243	188
A1Q21	2N5246	TRANSISTOR	01295	3-30243	189
A1Q22	2N4402	TRANSISTOR	27014	3-30259	190
A1Q23	2N5246	TRANSISTOR	01295	3-30243	191
A1Q24	2N4400	TRANSISTOR	81349	3-30257	192
A1Q25	2N5246	TRANSISTOR	01295	3-30243	193
					194
					195
					196
					197
A1R1	RC07GF5R6J	RESISTOR 5.6Ω 1/4W 5%	81349	5-10147	198
A1R2	RC20GF681J	RESISTOR 680Ω 1/2W 5%	81349	5-20119	199
A1R3	RN60D1001F	RESISTOR 1K 1/4W 1%	81349	5-60020	200
A1R4	RN60D1001F	RESISTOR 1K 1/4W 1%	81349	5-60020	201
A1R5	RN60D1001F	RESISTOR 1K 1/4W 1%	81349	5-60020	202
A1R6	RN60D1371F	RESISTOR 1.37K 1/4W 1%	81349	5-60024	203
A1R7	RN60D2671F	RESISTOR 2.67K 1/4W 1%	81349	5-60416	204
A1R8	RC20GF681J	RESISTOR 680Ω 1/2W 5%	81349	5-20119	205
A1R9	RC07GF5R6J	RESISTOR 5.6Ω 1/4W 5%	81349	5-10147	206
A1R10	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	207
A1R11	RC07GF105J	RESISTOR 1M 1/4W 5%	81349	5-10123	208
A1R12	RC07GF100J	RESISTOR 10Ω 1/4W 5%	81349	5-10005	209
A1R13	RC07GF181J	RESISTOR 180Ω 1/4W 5%	81349	5-10035	210
A1R14	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	211
A1R15	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	212
A1R16	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	213
A1R17	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	214
A1R18	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	215
A1R19		NOT USED			216

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PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R20		NOT USED			217
A1R21		NOT USED			218
A1R22		NOT USED			219
A1R23	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	220
A1R24	RC07GF225J	RESISTOR 2.2M 1/4W 5%	81349	5-10126	221
A1R25	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	222
A1R26	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	223
A1R27	RC07GF221J	RESISTOR 220Ω 1/4W 5%	81349	5-10037	224
A1R28	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	225
A1R29	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	226
A1R30	Model 91A-50Ω	POTENTIOMETER 50Ω	73138	5-70201	227
A1R31	PME55-9.98K-.1-.1	-50PPM RESISTOR 9.98K .1%	03888	5-80315	228
A1R32	RN60D2213F	RESISTOR 221K 1/4W 1%	81349	5-60667	229
A1R33	Model 91A-500Ω	POTENTIOMETER 500Ω	73138	5-70220	230
A1R34	PME55-100.8K-.1-.	1-50PPM RESISTOR 100.8K .1%	03888	5-80317	231
A1R35	PME55-1.01K-.1-.1	-50PPM RESISTOR 1.01K .1%	83888	5-80318	232
A1R36	Model 91A-50Ω	POTENTIOMETER 50Ω	73138	5-70201	233
A1R37	PME55-91.1K-.1-.1	-50PPM RESISTOR 91.1K .1%	03888	5-80319	234
A1R38	Model 91A-500Ω	POTENTIOMETER 500Ω	73138	5-70220	235
A1R39	PME55-10K-.1-.1-50	PPM RESISTOR 10K .1%	03888	5-80320	236
A1R40	Model 91A-5K	POTENTIOMETER 5K	73138	5-70219	237
A1R41	PME60-998K-.1-.12	-50PPM RESISTOR 998K .1%	03888	5-80321	238
A1R42		NOT USED			239
A1R43	Model 89W-100Ω	POTENTIOMETER 100Ω	73138	5-70240	240
A1R44	3299W-1-103	POTENTIOMETER 10K	80294	5-70208	241
A1R45	RC07GF394J	RESISTOR 390K 1/4W 5%	81349	5-10141	242
A1R46	RC07GF223J	RESISTOR 22K 1/4W 5%	81349	5-10084	243
A1R47	RC07GF181J	RESISTOR 180Ω 1/4W 5%	81349	5-10035	244
A1R48	PME70-1M-.1-.5-25	PPM RESISTOR 1M .1%	03888	5-80322	245
A1R49	RC07GF513J	RESISTOR 51K 1/4W 5%	81349	5-10093	246
A1R50	RC07GF513J	RESISTOR 51K 1/4W 5%	81349	5-10093	247
A1R51	RC07GF223J	RESISTOR 22K 1/4W 5%	81349	5-10084	248
A1R52	RC07GF104J	RESISTOR 100K 1/4W 5%	81349	5-10100	249
A1R53	PME55-562Ω-.1-.1-25	PPM RESISTOR 562Ω .1%	03888	5-80323	250
A1R54	PME55-562Ω-.1-.1-25	PPM RESISTOR 562Ω .1%	03888	5-80323	251
A1R55	RN60D1622F	RESISTOR 16.2K 1/4W 1%	81349	5-60094	252

MODEL DMM40 | CALICO P/N 200475 | ASSY R.D. A1

TITLE ANALOG/DIGITAL BOARD ASSY | SHT 9 OF 13

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R56	RN60D1622F	RESISTOR 16.2K 1/4W 1%	81349	5-60094	253
A1R57	RN60D1622F	RESISTOR 16.2K 1/4W 1%	81349	5-60094	254
A1R58	RN60D1622F	RESISTOR 16.2K 1/4W 1%	81349	5-60094	255
A1R59	RN60D3162F	RESISTOR 31.6K 1/4W 1%	81349	5-60668	256
A1R60	RN60D3162F	RESISTOR 31.6K 1/4W 1%	81349	5-60668	257
A1R61	Model 91A-10K	POTENTIOMETER 10K	73138	5-70203	258
A1R62	RC07GF515J	RESISTOR 5.1M 1/4W 5%	81349	5-10150	259
A1R63	RC07GF106J	RESISTOR 10M 1/4 5%	81349	5-10135	260
A1R64	Model 91A-10Ω	POTENTIOMETER 10Ω	73138	5-70202	261
A1R65	PME55-137.4Ω-.1-.1-25PPM	RESISTOR 137.4Ω .1%	03888	5-80325	262
A1R66	PME55-274.9K-.1-.1-25PPM	RESISTOR 274.9K .1%	03888	5-80326	263
A1R67	Model 91A-2K	POTENTIOMETER 2K	73138	5-70222	264
A1R68	PME55-30.41K-.1-.1-25PPM	RESISTOR 30.41K .1%	03888	5-80327	265
A1R69	Model 91A-200Ω	POTENTIOMETER 200Ω	73138	5-70238	266
A1R70	PME55-2.637K-.1-.1-25PPM	RESISTOR 2.637K .1%	03888	5-80328	267
A1R71	Model 91A-50Ω	POTENTIOMETER 50Ω	73138	5-70201	268
A1R72	PME55-137.4Ω-.1-.1-25PPM	RESISTOR 137.4Ω .1%	03888	5-80325	269
A1R73	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	270
A1R74	CSN7-1Ω-.1%	RESISTOR 1Ω .1% 7W	05347	5-50205	271
A1R75	RC32GF115J	RESISTOR 1.1M 5% 1W	81349	5-30081	272
A1R76	200498-01	RESISTOR SET (10M .1%)	16067	5-80316	273
A1R77	Model 91A-10K	POTENTIOMETER 10K	73138	5-70203	274
A1R78	200498-01	RESISTOR SET (995K .1%)	16067	5-80316	275
A1R79	RC07GF914J	RESISTOR 910K 1/4W 5%	81349	5-10122	276
A1R80	Model 91A-1K	POTENTIOMETER 1K	73138	5-70204	277
A1R81	200498-01	RESISTOR SET (99.50K .1%)	16067	5-80316	278
A1R82	RC07GF105J	RESISTOR 1M 1/4W 5%	81349	5-10123	279
A1R83	Model 91A-100Ω	POTENTIOMETER 100Ω	73138	5-70205	280
A1R84	200498-01	RESISTOR SET (11.067K .1%)	16067	5-80316	281
A1R85	RN60D1002F	RESISTOR 10K 1/4W 1%	81349	5-60079	282
A1R86	RN60D1002F	RESISTOR 10K 1/4W 1%	81349	5-60079	283
A1R87	PME55-9K-.1-.1-25PPM	RESISTOR 9K .1%	03888	5-80324	284
A1R88	Model 89W-2K	POTENTIOMETER 2K	73138	5-70239	285
A1R89		NOT USED			286
A1R90	Model 91A-20Ω	POTENTIOMETER 20Ω	73138	5-70206	287
A1R91	PME55-1K-.1-.1-25PPM	RESISTOR 1K .1%	03888	5-80329	288

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TITLE	ANALOG/DIGITAL BOARD ASSY	SHT	OF 10 13	

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R92	NOT USED				289
A1R93	RC07GF100J	RESISTOR 10Ω 1/4W 5%	81349	5-10005	290
A1R94	RC07GF104J	RESISTOR 100K 1/4W 5%	81349	5-10100	291
A1R95	RC07GF104J	RESISTOR 100K 1/4W 5%	81349	5-10100	292
A1R96	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	293
A1R97	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	294
A1R98	RC07GF912J	RESISTOR 9.1K 1/4W 5%	81349	5-10075	295
A1R99	RC07GF303J	RESISTOR 30K 1/4W 5%	81349	5-10087	296
A1R100	PME55-50K-.1-.1-25PPM	RESISTOR 50K .1%	03888	5-80382	297
A1R101	RC07GF105J	RESISTOR 1M 1/4W 5%	81349	5-10123	298
A1R102	RC07GF105J	RESISTOR 1M 1/4W 5%	81349	5-10123	299
A1R103	RC07GF105J	RESISTOR 1M 1/4W 5%	81349	5-10122	300
A1R104		NOT USED			301
A1R105	RC07GF473J	RESISTOR 47K 1/4W 5%	81349	5-10092	302
A1R106	RC07GF473J	RESISTOR 47K 1/4W 5%	81349	5-10092	303
A1R107	RC07GF104J	RESISTOR 100K 1/4W 5%	81349	5-10100	304
A1R108	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	305
A1R109	PME55-250K-.1-.1-25PPM	RESISTOR 250K .1%	03888	5-80330	306
A1R110	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	307
A1R111	PME55-250K-.1-.1-25PPM	RESISTOR 250K .1%	03888	5-80330	308
A1R112	RC07GF330J	RESISTOR 33Ω 1/4W 5%	81349	5-10017	309
A1R113	RC07GF223J	RESISTOR 22K 1/4W 5%	81349	5-10084	310
A1R114	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	311
A1R115	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	312
A1R116	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	313
A1R117	RC07GF333J	RESISTOR 33K 1/4W 5%	81349	5-10088	314
A1R118	RC07GF105J	RESISTOR 1M 1/4W 5%	81349	5-10123	315
A1R119	RC07GF473J	RESISTOR 47K 1/4W 5%	81349	5-10092	316
A1R120	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	317
A1R121	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	318
A1R122	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	319
A1R123	CIC 709-1	WHT DOT RESISTOR (Part of Ref. Set.)	16067	3-10225	320
A1R124	RC07GF202J	RESISTOR 2K 1/4W 5%	81349	5-10059	321
A1R125	RC07GF681J	RESISTOR 680Ω 1/4W 5%	81349	5-10049	322
A1R126	PME55-10K-.1-.1-25PPM	RESISTOR 10K .1%	03888	5-80331	323
A1R127	Model 91A-20Ω	POTENTIOMETER 20Ω	73138	5-70206	324

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CALIFORNIA INSTRUMENTS CO.
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CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R128	PME55-10K-.1-.1-25PPM	RESISTOR 10K .1%	03888	5-80331	325
A1R129	3299W-1-102	POTENTIOMETER 1K	80294	5-70218	326
A1R130	PME55-2.49K-1-.1-25PPM	RESISTOR 2.49K 1%	03888	5-80332	327
A1R131	RC07GF512J	RESISTOR 5.1K 1/4W 5%	81349	5-10069	328
A1R132	PME55-4.75K-1-.1-25PPM	RESISTOR 4.75K 1%	03888	5-80333	329
A1R133	Model 91A-100Ω	POTENTIOMETER 100Ω	73138	5-70205	330
A1R134	Model 91A-100Ω	POTENTIOMETER 100Ω	73138	5-70205	331
A1R135	RN60D4751F	RESISTOR 4.75K 1/4W 1%	83149	5-60050	332
A1R136	RN60D4751F	RESISTOR 4.75K 1/4W 1%	83149	5-60050	333
A1R137	RC07GF105J	RESISTOR 1M 1/4W 5%	81349	5-10123	334
A1R138	RC07GF105J	RESISTOR 1M 1/4W 5%	81349	5-10123	335
A1R139	RN60D	RESISTOR T.B.D.	81349		336
A1R140	RC07GF333J	RESISTOR 33K 1/4W 5%	81349	5-10088	337
A1R141	RC07GF184J	RESISTOR 180K 1/4W 5%	81349	5-10106	338
					339
					340
					341
					342
					343
A1S1	8-64212	SWITCH, PUSH BUTTON	16067	2-40453	344
					345
A1VR1	LM309K	REGULATOR	27014	3-60007	346
					347
A1Y1	ER-1214	CRYSTAL 1.0 MHz	13571	2-50224	348
					349
A1Z1	A7R381419	INTEGRATED CIRCUIT	07263	3-60061	350
A1Z2	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	351
A1Z3	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	352
A1Z4	SN7404N	INTEGRATED CIRCUIT	01295	3-60002	353
A1Z5	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	354
A1Z6	SN7486N	INTEGRATED CIRCUIT	01295	3-60062	355
A1Z7	SN7404N	INTEGRATED CIRCUIT	01295	3-60002	356
A1Z8	SN7420N	INTEGRATED CIRCUIT	01295	3-60012	357
A1Z9	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	358
A1Z10	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	359
A1Z11	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	360

MODEL	CALICO P/N	ASSY R.D.
DMM40	200475	
TITLE ANALOG/DIGITAL BOARD ASSY	SHT 12 OF 13	A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1Z12	SN74192N	INTEGRATED CIRCUIT	01295	3-60014	361
A1Z13	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	362
A1Z14	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	363
A1Z15	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	364
A1Z16	SN7410N	INTEGRATED CIRCUIT	01295	3-60051	365
A1Z17	SN7440N	INTEGRATED CIRCUIT	01295	3-60063	366
A1Z18	SN7432N	INTEGRATED CIRCUIT	01295	3-60064	367
A1Z19	SN7432N	INTEGRATED CIRCUIT	01295	3-60064	368
A1Z20	NE555V	INTEGRATED CIRCUIT	18324	3-60026	369
A1Z21	SN72709P	INTEGRATED CIRCUIT	01295	3-60065	370
A1Z22	SN72709P	INTEGRATED CIRCUIT	01295	3-60065	371
A1Z23	SN7404N	INTEGRATED CIRCUIT	01295	3-60002	372
					373
	CA-24S-TSD	SOCKET, 24 PIN	52072	3-60059	374
	NC632-3B	HEATSINK	05820	2-10510	375
					376
	201-8550-000	POL KEY	71468	4-10231	377
	9631B-B-0440	SPACER - THD	06540	2-10511	378
					379
	#253-.37 WIDE	MYLAR TAPE .37 WIDE	99742		380
	MIL-W-16878D/C-24-9	WIRE, INS. 24 AWG, WHT	81349		381
	C-24(19)N-S1V *	WIRE, 1 COND. SHLD.	81349		382
	C-24(19)N-S2V *	WIRE, 2 COND. SHLD.	81349		383
	MIL-W-16878D/C-24-2	WIRE, INS. 24 AWG. RED	81349		384
	MIL-W-16878D/C-24-5	WIRE, INS. 24 AWG GRN	81349		385
					386
	* MIL-W-16878D				387
					388
					389
	2169	FIBER WASHER	83330	2-10546	390
	10274	CRYSTAL SPACER PAD	0000W	2-10521	391
					392
					393
					394
					395
					396

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TITLE ANALOG/DIGITAL BOARD ASSY | SHT 13 OF 13

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2	200470-01	DISPLAY BOARD ASSY	16067	--	1
					2
	200472-02	P.C. BOARD	16067	1-60210	3
	200479-01	SHIELD	16067	2-10499	4
					5
					6
A2C1	C280AE/A10K	CAPACITOR .01μF 250V	73445	6-10929	7
A2C2	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	8
					9
					10
A2DS1	SP331	DISPLAY, 7 BAR	07713	2-30064	11
A2DS2	SP332	DISPLAY, 7 BAR	07713	2-30065	12
A2DS3	SP332	DISPLAY, 7 BAR	07713	2-30065	13
					14
					15
A2Q1	2N5550	TRANSISTOR	81349	3-30255	16
A2Q2	2N5550	TRANSISTOR	81349	3-30255	17
					18
					19
A2R1	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	20
A2R2	RC07GF334J	RESISTOR 330K 1/4W 5%	81349	5-10112	21
A2R3	RC07GF184J	RESISTOR 180K 1/4W 5%	81349	5-10106	22
A2R4	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	23
A2R5	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	24
A2R6	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	25
A2R7	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	26
A2R8	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	27
A2R9	RC07GF184J	RESISTOR 180K 1/4W 5%	81349	5-10106	28
A2R10	RC07GF184J	RESISTOR 180K 1/4W 5%	81349	5-10106	29
A2R11	RC07GF184J	RESISTOR 180K 1/4W 5%	81349	5-10106	30
A2R12	RC07GF184J	RESISTOR 180K 1/4W 5%	81349	5-10106	31
A2R13	RC07GF184J	RESISTOR 180K 1/4W 5%	81349	5-10106	32
A2R14	RC07GF184J	RESISTOR 180K 1/4W 5%	81349	5-10106	33
A2R15	RC07GF205J	RESISTOR 2M 1/4W 5%	81349	5-10159	34
A2R16	RC07GF205J	RESISTOR 2M 1/4W 5%	81349	5-10159	35
A2R17	RC07GF205J	RESISTOR 2M 1/4W 5%	81349	5-10159	36

MODEL	DMM40	CALICO P/N	200470	ASSY R.D.
TITLE	DISPLAY BOARD ASSY	SHT	3 OF 4	A2

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2R18	RC07GF205J	RESISTOR 2M 1/4W 5%	81349	5-10159	37
A2R19	RC07GF205J	RESISTOR 2M 1/4W 5%	81349	5-10159	38
A2R20	RC07GF205J	RESISTOR 2M 1/4W 5%	81349	5-10159	39
					40
					41
					42
					43
					44
					45
					46
A2Z1	DD700	INTEGRATED CIRCUIT	07713	3-60053	47
A2Z2	DD700	INTEGRATED CIRCUIT	07713	3-60053	48
A2Z3	DD700	INTEGRATED CIRCUIT	07713	3-60053	49
A2Z4	SN7441AN	INTEGRATED CIRCUIT	01295	3-60003	50
A2Z5	DD700	INTEGRATED CIRCUIT	07713	3-60053	51
A2Z6	DD700	INTEGRATED CIRCUIT	07713	3-60053	52
					53
					54
					55
					56
					57
					58
					59
					60
					61
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					72

MODEL DMM40 | CALICO P/N 200470 | ASSY R.D. A2

TITLE DISPLAY BOARD ASSEMBLY | SHT 4 OF 4

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3	200480-01	DATA OUTPUT BOARD ASSY	16067	--	1
					2
	200482-02	BOARD, P.C.	16067	1-60211	3
	200483-01	BRACKET	16067	1-10458	4
					5
A3C1	C350AG/P1KCF	CAPACITOR .001μF 630V	73445	6-10925	6
A3C2	C280AE/A2K7	CAPACITOR .0027μF 250V	73445	6-10926	7
A3C3	C350AG/P1KCF	CAPACITOR .001μF 630V	73445	6-10925	8
A3C4	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	9
A3C5	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	10
A3C6	ET681X040A03	CAPACITOR 680μF 40V	73445	6-10928	11
					12
					13
					14
A3CR1	1N4001	DIODE	77638	3-10172	15
A3CR2	1N4001	DIODE	77638	3-10172	16
A3CR3	1N5730B	DIODE	73445	3-10234	17
A3CR4	1N4001	DIODE	77638	3-10172	18
A3CR5	1N4001	DIODE	77638	3-10172	19
					20
A3J1	57-40360	CONNECTOR, RECEPT	02660	4-10208	21
					22
A3P1	5532-008	CABLE ASSY	08261	4-10214	23
					24
A3Q1	T1P29	TRANSISTOR W/HARDWARE	01295	3-30241	25
					26
					27
A3R1	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	28
A3R2	RC07GF471J	RESISTOR 470Ω 1/4W 5%	81349	5-10045	29
A3R3	RC07GF510J	RESISTOR 51Ω 1/4W 5%	81349	5-10022	30
A3R4	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	31
A3R5	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	32
A3R6	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	33
A3R7	RC07GF221J	RESISTOR 220Ω 1/4W 5%	81349	5-10037	34
A3R8	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	35
A1R9	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	36

MODEL	DMM40-OPTION 02	CALICO P/N 200480		ASSY R.D.
TITLE	DATA OUTPUT OPTION		SHT 3 OF 5	A3

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3R10	RC07GF221J	RESISTOR 220Ω 1/4W 5%	81349	5-10037	37
A3R11	RC07GF221J	RESISTOR 220Ω 1/4W 5%	81349	5-10037	38
A3R12	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	39
A3R13	RC07GF221J	RESISTOR 220Ω 1/4W 5%	81349	5-10037	40
A3R14	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	41
A3R15	RC07GF221J	RESISTOR 220Ω 1/4W 5%	81349	5-10037	42
A3R16	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	43
A3R17	RC07GF221J	RESISTOR 220Ω 1/4W 5%	81349	5-10037	44
A3R18	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	45
A3R19	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	46
A3R20	RC42GF330J	RESISTOR 33Ω 2W 5%	81349	5-40018	47
A3R21	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	48
A3R22	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	49
					50
					51
A3T1	200494-01	TRANSFORMER	16067	7-10263	52
					53
					54
A3Z1	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	55
A3Z2	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	56
A3Z3	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	57
A3Z4	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	58
A3Z5	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	59
A3Z6	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	60
A3Z7	SN7404N	INTEGRATED CIRCUIT	01295	3-60002	61
A3Z8	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	62
A3Z9	SN7404N	INTEGRATED CIRCUIT	01295	3-60002	63
A3Z10	SN7475N	INTEGRATED CIRCUIT	01295	3-60004	64
A3Z11	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	65
A3Z12	MOC1001	INTEGRATED CIRCUIT	04713	3-60055	66
A3Z13	MOC1001	INTEGRATED CIRCUIT	04713	3-60055	67
A3Z14	MOC1001	INTEGRATED CIRCUIT	04713	3-60055	68
A3Z15	MOC1001	INTEGRATED CIRCUIT	04713	3-60055	69
A3Z16	MOC1001	INTEGRATED CIRCUIT	04713	3-60055	70
A3Z17	MOC1001	INTEGRATED CIRCUIT	04713	3-60055	71
A3Z18	SN7404N	INTEGRATED CIRCUIT	01295	3-60002	72

MODEL DMM40 - OPTION 02 | CALICO P/N 200480 | ASSY R.D. A3

TITLE DATA OUTPUT OPTION | SHT 4 OF 5

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3Z19	SN7410N	INTEGRATED CIRCUIT	01295	3-60051	73
A3Z20	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	74
					75
					76
					77
	P 253	TAPE, MYLAR .75 WIDE	07080		78
					79
	57-30360	CONNECTOR, PLUG	02660	4-10209	80
					81
					82
					83
					84
					85
					86
					87
					88
					89
					90
					91
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					101
					102
					103
					104
					105
					106
					107
					108

MODEL DMM40 - OPTION 02 | CALICO P/N 200480 | ASSY R.D. A3

TITLE DATA OUTPUT OPTION | SHT 5 OF 5

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	200501-01	BATTERY PACK OPTION 01	16067	--	1
					2
	DELETE FROM STA	NDARD UNIT:			3
	200468-01	COVER-TOP	16067	1-10445	4
					6
	ADD TO STANDARD	UNIT:			
NOTE:	ITEM NO'S ARE THO	SE USED ON DWG. 200460 - SEE ERA			
A4	200485-01	ASSY - BATTERY PACK	16067	--	34
	200468-02	COVER - TOP	16067	1-10449	35
	200471-01	BRACKET - POWER CORD	16067	1-10450	36
	200478-01	SUPPORT - BATTERY	16067	1-10451	37
	GC 660	BATTERY, 6V	99028	2-50216	38
	1653-P-1	CONNECTOR, PLUG	07264	4-10210	39
	1653-R-2	CONNECTOR, RECEPT	07264	4-10211	40
	1380TL	CONTACT - MALE	07264	4-10212	41
	1381TL	CONTACT - FEMALE	07264	4-10213	42
					43
	200507	DECAL - BAT. DISCH. CURVE	16067	2-10509	55
	534 (1/4") GRY	TAPE-URETHANE FOAM	21270		56
		(1/4W x 1/8 THK x 4.4LG.)			-

MODEL	CALICO P/N	ASSY R.D.
DMM40 - OPTION 01	200501	
TITLE BATTERY PACK OPTION	SHT 2 OF 2	

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A4	200485-01	BATTERY PACK ASSY	16067	--	1
					2
	200487-01	P.C. BOARD	16067	1-60212	3
	200484-01	BRACKET, SUPPORT	16067	1-10455	4
	200491-01	BRACKET	16067	1-10456	5
	200492-01	COVER, WARNING	16067	1-10457	6
					7
					8
A4C1	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	9
					10
					11
A4CR1	1N5731B	DIODE, ZENER	73445	3-10235	12
A4CR2	KBP005	DIODE, RECTIFIER	77638	3-10237	13
A4CR3	1N5732B	DIODE, ZENER	73445	3-10236	14
					15
					16
A4F1	315002	FUSE 2A S/B	75915	2-70046	17
					18
A4Q1	2N4400	TRANSISTOR	81349	3-30257	19
A4Q2	T1P29	TRANSISTOR	01295	3-30241	20
A4Q3	T1P29	TRANSISTOR	01295	3-30241	21
A4Q4	2N4400	TRANSISTOR	81349	3-30257	22
A4Q5	T1P33	TRANSISTOR	01295	3-30258	23
					24
					25
A4R1	RC07GF822J	RESISTOR 8.2K 1/4W 5%	81349	5-10074	26
A4R2	RC07GF512J	RESISTOR 5.1K 1/4W 5%	81349	5-10069	27
A4R3	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	28
A4R4	RC07GF392J	RESISTOR 3.9K 1/4W 5%	81349	5-10066	29
A4R5	RC07GF392J	RESISTOR 3.9K 1/4W 5%	81349	5-10066	30
A4R6	RC07GF561J	RESISTOR 560Ω 1/4W 5%	81349	5-10047	31
A4R7	RC07GF223J	RESISTOR 22K 1/4W 5%	81349	5-10084	32
A4R8	RC07GF223J	RESISTOR 22K 1/4W 5%	81349	5-10084	33
A4R9	4749/995-10A	RESISTOR 5Ω 11W 5%	44655	5-50009	34
A4R10	RC20GF391J	RESISTOR 390Ω 1/2W 5%	81349	5-20027	35
A4R11	MODEL 91A-100Ω	POTENTIOMETER 100Ω	73138	5-70205	36

MODEL DMM40 - OPTION 01	CALICO P/N 200485	ASSY R.D.
TITLE BATTERY PACK ASSEMBLY	SHT 3 OF 4	A4

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A4R12	RC07GF513J	RESISTOR 51K 1/4W 5%	81349	5-10093	37
					38
					39
					40
A4S1	8-64140	SWITCH	16067	2-40452	41
					42
A4TP1	221-BLK	BLK	83330	2-50214	43
A4TP2	221-RED	RED	83330	2-50215	44
					45
					46
A4Z1	NE 555V	INTEGRATED CIRCUIT	18324	3-60026	47
A4Z2	MC 848P	INTEGRATED CIRCUIT	04713	3-60056	48
					49
					50
					51
	02-09-1132	CONTACT, FEMALE	27264	4-10205	52
	02-09-2132	CONTACT, MALE	27264	4-10204	53
					54
	9620C-B-0256	STANDOFF, SWAGE	06540	2-10506	55
					56
					57
					58
	DANGER H.V. DECAL .75 x 1.50		00544	1-20027	59
					60
					61
					62
					63
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					71
					72

MODEL	DMM40 - OPTION 01	CALICO P/N	200485	ASSY R.D.
TITLE	BATTERY PACK OPTION	SHT	4 OF 4	A4

APPENDIX A

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbook H4-1 and its latest supplement. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbook.

0000A	ElectriCord	Westfield, Pa.
0000B	Tech. Prod. Sales	Sorrento Valley, Ca.
0000C	Jackson Bros.	Waddon, Surrey, England
0000D	Chicago Std. Transformer Co.	Chicago, Ill.
0000E	Use Code #08289	
0000F	Colvern	Santa Monica, Ca.
0000G	Use Code #30983	
0000H	Mial Of Italy c/o Q. C. Components	Los Angeles, Ca.
0000I	Monsanto, Electronic Special Products	Cupertino, Ca.
0000J	Silicon General	Los Angeles, Ca.
0000K	Elma	Schweiz, Germany
0000L	Intersil	Cupertino, Ca.
0000M	Precision Dynamics Corp.	Burbank, Ca.
0000N	Analey	Los Angeles, Ca.
0000R	American Handle	Philadelphia, Pa.
0000S	OPCDA	Edison, N. J.
0000T	Elpower	Santa Ana, Ca.
0000U	Use Code #0000L	
0000V	Falmat	Los Angeles, Ca.
00141	Pic Design Corp.	E. Rockaway, N. Y.
00544	Metal-Cal Div., Avery Prod. Corp.	Inglewood, Ca.
00656	Aerovox Corporation	New Bedford, Mass.
00779	AMP, Inc.	Harrisburg, Pa.
00853	Sangamo Electric Company	Pickens, S. C.
00866	Goe Eng. Co., Inc.	City of Industry, Ca.
01121	Allen-Bradley Company	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Ca.
01281	T R W Semiconductors, Inc.	Lawndale, Ca.
01295	Texas Instruments, Inc.	Dallas, Tex.
02111	Spectrol Electronics	City of Industry, Ca.
02114	Ferroxcube Corp.	Saugerties, N. Y.
02335	Fairchild Controls Corp.	Hicksville, Ll, N. Y.
02660	Amphenol Corporation	Broadview, Ill.
02799	Use Code #72136	
03507	General Electric Company	Syracuse, N. Y.
03508	General Electric Company	Syracuse, N. Y.
03516	General Electric Company	Somersworth, N. H.
03797	Eldema Corporation	Compton, Ca.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N. J.
03911	Clairex Corporation	New York, N. Y.
04009	Arrow-Hart and Hegeman Elec. Co.	Hartford, Ct.
04062	Use Code #72136	
04713	Motorola Semiconductor Prod., Inc.	Phoenix, Ariz.
04963	3-M	St. Paul, Minn.
05236	Jonathan Mfg. Co.	Fullerton, Ca.
05276	Pomona Electronics Co., Inc.	Pomona, Ca.
05347	Ultronixs	Grand Junction, Colo.
05397	Kemet, Union Carbide Corp.	Cleveland, Ohio
05820	Wakefield Engineering, Inc.	Wakefield, Mass.
06184	Conelco Components	San Bernadino, Ca.
06223	Kooltronic Fan Company	Princeton, N. J.
06229	Electrovert, Incorporated	Mt. Vernon, N. Y.
06514	Stantron, Wyco Metal Products	N. Hollywood, Ca.
06540	Amathom Elect. Hardward	New Rochelle, N. Y.
06682	Magnetic Shield Div.	Chicago, Ill.
06776	Robinson, Nugent, Inc.	New Albany, Ind.
06915	Richco Plastics, Co.	Chicago, Ill.
07088	Kelvin Electric Company	Van Nuys, Ca.
07256	Silicon Transistor Corp.	Garden City, N. Y.
07263	Fairchild Camera and Instr. Corp.	Mt. View, Ca.
07387	Birtcher Corporation	Los Angeles, Ca.
07556	Unitrack Calabro Plastics	Upper Darby, Pa.
07713	Sperry Rand Corporation	Norwalk, Conn.
07716	I R C, Incorporated	Burrington, Iowa
07910	Continental Devices	Hawthorne, Ca.
08065	Accurate Rubber and Plastics Co.	San Diego, Ca.
08261	Spectra Strip	Garden Grove, Ca.
08289	Blinn-Delbert Co., Inc.	Pomona, Ca.
08718	Use Code #71468	
08730	Vemaline Products Co.	Franklin Lakes, N. J.
09026	Babcock Electronics Corp.	Costa Mesa, Ca.
09145	Atohm, Technical Industries, Inc.	Burbank, Ca.
09353	C and K Components, Inc.	Newton, Mass.
11432	Diamond Metal Sales	Gardena, Ca.
11815	Cherry Rivet Div., Townsend Co.	Santa Ana, Ca.
12020	Ovenaire, Incorporated	Charlottesville, Va.
12143	Bendix Corporation	Santa Ana, Ca.
12405	Hysol Corporation	El Monte, Ca.
12406	Elpac, Incorporated	Fullerton, Ca.
12463	Omtronics Mfg., Incorporated	Omaha, Neb.
12697	Clarostat Mfg. Co., Incorporated	Dover, N. H.
13103	Thermalloy Company	Dallas, Tex.
13454	Texas Crystals	River Grove, Ill.
13571	Electronic Research	Overland Park, Kans.
13919	Burr-Brown Research Corp.	Tucson, Ariz.
14099	Semtech Corporation	Newbury Park, Ca.
14655	Cornell-Dubilier Elect. Corp.	Newark, N. J.
14726	Hollingsworth Co.	Phoenixville, Pa.
14752	Electro Cube, Incorporated	San Gabriel, Ca.
15112	Electra Scientific Corporation	Fullerton, Ca.
15636	Elec-trol	Northridge, Ca.
15801	Fenwall Electronics	Framingham, Mass.
15818	Amelco, Teledyne, Incorporated	Mt. View, Ca.
15909	Use Code #17870	
15912	Digital Sensors, Incorporated	Los Angeles, Ca.
16067	California Instruments Company	San Diego, Ca.
16758	Delco Radio Div., General Motors	Kokomo, Ind.
16902	Simpson Instruments, Inc.	Escondido, Ca.
17745	Angstrohm Precision, Inc.	Van Nuys, Ca.
17838	Mektron, California General, Inc.	Chula Vista, Ca.
17870	Daven Div., Thomas A. Edison	Manchester, N. H.
18076	Umpco	City of Industry, Ca.
18121	Wilshire Foam Products, Inc.	Gardena, Ca.
18178	Vactec Inc.	Maryland Heights, Mo.
18324	Signatics	Sunnyvale, Ca.
18612	Vishay Instruments Inc.	Malvern, Pa.
18677	Scambe Mfg. Co.	Monterey Park, Ca.
18702	Ducommun Metals and Supply Co.	Los Angeles, Ca.
18722	R C A	Mountaintop, Pa.
19080	The Robinson Company	Hawthorne, Ca.
19781	Potter Company	Sun Valley, Ca.
20857	South Bay Cable Corp.	Gardena, Ca.
21270	Behr-Manning	Watervliet, N. Y.
21604	Buckeye Stamping Company	Columbus, Ohio
22045	Jordan Elect	Van Nuys, Ca.
22599	Elastic Stop Nut Corporation	Van Nuys, Ca.
23039	Deccofelt Products Company	Glendora, Ca.
23050	Product Components Corp.	Hastings-on-Hudson, N. Y.
23783	British Radio Electric Ltd.	Washington, D. C.
23936	Pamotor, Incorporated	San Francisco, Ca.
24011	E C C	Burlington, Mass.
24796	Parelco Inc.	Paramount, Ca.
24931	Specialty Connector Co., Inc.	Indianapolis, Inc.
25403	Amperex (Diodes)	Slaterville, R. I.
25684	Victoreen Instrument Co., Inc.	Oak Lawn, Ill.
25706	Daburn Electronics and Cable Corp.	New York, N. Y.
26528	Lamcor, Incorporated	Anaheim, Ca.
26533	Zero Manufacturing Company	Burbank, Ca.
27014	National Semi-Conductor Corp.	Santa Clara, Ca.
27191	Cutler-Hammer, Inc.	Milwaukee, Wisc.
27264	Molex	Downers Grove, Ill.
27556	IMB Electronic Products	Santa Fe Springs, Ca.
27683	Varo, Incorporated	St. Garland, Tex.
28480	Hewlett-Packard Co.	Palo Alto, Ca.
28520	Heyman Mfg. Company (Heyco)	Kenilworth, N. J.
30086	I-T-E Circuit Breaker Co.	Philadelphia, Pa.
30817	Instrument Specialties Co.	Little Falls, N. J.
30983	Electra/Midland	San Diego, Ca.
31951	Tririge Inc.	Pittsbury, Pa.
35929	Constanta	Quebec, Canada
42190	Muter Company	Chicago, Ill.
44655	Ohmite Manufacturing Company	Skokie, Ill.
45722	Parker-Kalon	Clifton, N. J.
46384	Penn. Eng. and Mfg. Corp.	Doylestown, Pa.
49956	Raytheon Co.	Lexington, Ma.
53209	W. H. Brady Co.	Milwaukee, Wis.
56289	Sprague Electric Company	North Adams, Mass.
58474	Superior Electric Company	Bristol, Ct.
59730	Thomas and Betts Company	Elizabeth, N. J.
60741	Triplett Electrical Instrument Co.	Bluffton, Ohio
63743	Ward Leonard Electric Co.	Mt. Vernon, N. Y.
70903	Belden Manufacturing Co.	Chicago, Ill.
71002	Birnbach Radio Company, Inc.	New York, N. Y.
71279	Cambridge Thermionic Corp.	Cambridge, Mass.
71400	Bussman Mfg. Div., McGraw-Edison Co.	St. Louis, Mo.
71450	CTS Corporation	Elkhart, Ind.
71468	ITT Cannon Electric, Inc.	Los Angeles, Ca.
71590	Centralab Div., Globe-Union, Inc.	Milwaukee, Wis.
71744	Chicago Miniature Lampworks	Chicago, Ill.
71785	Cinch Manufacturing Company	Chicago, Ill.
72136	Elmenco (Electro Motive)	Willimantic, Ct.
72259	Nytronics, Incorporated	Berkeley Heights, N. J.
72619	Dialight Corporation	Brooklyn, N. Y.
72699	General Instruments	Newark, N. J.
72982	Erie Technological Products, Inc.	Erie, Pa.
73138	Beckman Instruments, Inc.	Fullerton, Ca.
73445	Amperex (Capacitors)	Long Island, N. Y.
73559	Carling Electric, Inc.	West Hartford, Ct.
73734	Federal Screw Products, Inc.	Chicago, Ill.
73899	J F D Electronics Company	Brooklyn, N. Y.
73949	Guardian Electric Mfg. Co.	Chicago, Ill.
73957	Groov-Pin Corporation	Ridgefield, N. J.
74193	Heinemann Electric Company	Trenton, N. J.
74276	Signalite, Incorporated	Neptune, N. J.
74542	Hoyt Electrical Instrument Works	Penacook, N. H.
74545	Harvey Hubbel, Inc.	Bridgeport, Ct.
74970	E. F. Johnson Company	Waseca, Minn.
75382	Kulka Electric Corporation	Mt. Vernon, N. Y.
75915	Littlefuse, Incorporated	Des Plaines, Ill.
75987	Use Code #95987	
76005	Mallory Controls	Frankfort, Ind.
76348	Miller Products Company	New York, N. Y.
76493	J. W. Miller Company	Los Angeles, Ca.
76854	Oak Manufacturing Company	Crystal Lake, Ill.
77342	Potter and Brumfield Div., Amer. Machine and Foundry Company	E. Princeton, Ind.
78189	Shakeproof Div., Illoms Tool Works	Chicago, Ill.
78299	Struthers-Dunn, Incorporated	Pitman, N. J.
78488	Stackpole Carbon Company	St. Marys, Pa.
78526	Stanwyck Winding Company, Inc.	Newburgh, N. Y.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78947	Ucinite Company	Newtonville, Mass.
79130	Johns-Manville Products Corp.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corporation	New Rochelle, N. Y.
80112	G. C. Electronics Company	Los Angeles, Ca.
80223	United Transformer Co.	New York, N. Y.
80294	Bourns, Incorporated	Riverside, Ca.
80368	Sylvania Electric Products, Inc.	New York, N. Y.
81073	Grayhill, Incorporated	La Grange, Ill.
81095	Triad Transformer Corp.	Venice, Ca.
81312	Winchester Electronics	Oakville, Ct.
81349	Military Spec., Standardization Division, Directorate of Logistic Services DSA	
82104	Standard Grigsby	Aurora, Ill.
82389	Switchcraft, Incorporated	Chicago, Ill.
82877	Rotron Manufacturing Co., Inc.	Woodstock, N. Y.
83058	Car Fastener Company	Cambridge, Mass.
83324	Rosan, Incorporated	Newport Beach, Ca.
83330	Herman H. Smith, Inc.	Brooklyn, N. Y.
83594	Burroughs Corporation	Plainfield, N. J.
83701	Electronic Devices, Incorporated	Yonkers, N. Y.
84171	Arco Electronics, Inc.	Great Neck, N. Y.
86684	R C A	Harrison, N. J.
87034	Marco-Oak Industries	Anaheim, Ca.
88026	Use Code ±27191	
88245	Useco Div., Litton Industries	Van Nuys, Ca.
90201	Mallory Capacitor Company	Indianapolis, Ind.
91506	Augat	Attlebord, Mass.
91637	Dale Electronics, Inc.	Columbus, Neb.
91662	Elco Corporation	Willow Grove, Pa.
91812	Janco Corporation	Burbank, Ca.
91833	Keystone Electronics Corp.	New York, N. Y.
91929	Micro Switch Div., Honeywell, Inc.	Freeport, Ill.
92194	Alpha Wire Corporation	Elizabeth, N. J.
92219	Waldom Electronics, Inc.	Chicago, Ill.
93332	Sylvania Electric Products, Inc.	Woburn, Mass.
94222	Southco, Incorporated	Lester, Pa.
95146	Alco Electronics Products	Lawrence, Mass.
95303	R C A	Cincinnati, Ohio
95416	Use Code #95146	
95987	Weckesser Company, Inc.	Chicago, Ill.
96682	Geneteco, Incorporated	Compton, Ca.
97525	Electronic Engineering Co.	Santa Ana, Ca.
97954	U.S. Components, Incorporated	Bronx, N. Y.
98159	Rubber Teck, Incorporated	Gardena, Ca.
98278	Microdot, Incorporated (Lerco)	S. Pasadena, Ca.
98291	Sealectro Corp.	Mamaroneck, N. Y.
98978	IERC	Burbank, Ca.
99028	Globe	Gardena, Ca.
99392	STM Corporation	Oakland, Ca.
99515	Marshall Industries	Monrovia, Ca.
99517	Vacco Industries	El Monte, Ca.
99800	Delevan Electronics Corporation	Aurora, N. Y.
99742	Permacel Div., Johnson and Johnson	New Brunswick, N. J.
99743	I M C	Maywood, Ca.

ONE YEAR WARRANTY

CALIFORNIA INSTRUMENTS COMPANY a division of AIKEN INDUSTRIES INC. warrants each instrument manufactured by them to be free from defects in material and workmanship for a period of one year from the date of shipment to the original purchaser. Excepted from this warranty are tubes, fuses, and batteries which carry the warranty of their original manufacturer where applicable. CALIFORNIA INSTRUMENTS COMPANY will service, replace, or adjust any defective part or parts, free of charge, when the instrument is returned to the Company freight prepaid, and when examination reveals that the fault has not occurred because of misuse or abnormal conditions of operation. Equipment repaired beyond the effective date of warranty or when abnormal usage has occurred will be charged at applicable rates. CALIFORNIA INSTRUMENTS COMPANY will submit an estimate for such charges before commencing repair if so requested.

PROCEDURE FOR SERVICE

If a fault develops, notify CALIFORNIA INSTRUMENTS COMPANY or its local representative, giving full details of the difficulty, and including the model number and serial number. On receipt of this information, service data or shipping instructions will be furnished. If shipment is indicated, forward the instrument, freight prepaid, to the authorized repair station indicated in the instruction. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the warranty.

DAMAGE IN TRANSIT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. CALIFORNIA INSTRUMENTS COMPANY will advise the disposition to be made of the equipment and arrange for repair or replacement. Please include model number and serial number when referring to the instrument.

MP MASTER
MA28082